The Role of the Southern Caucasus on Early Human Evolution and Expansion

– Refuge, Hub or Source Area?

Workshop organized by

Angela A. Bruch & David Lordkipanidze

October 15 - 20, 2013

Tbilisi, Georgia

Important Addresses and Phone Numbers

Location

Georgian National Museum
3 Purtseladze Street
0105 Tbilisi

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SkadaVeli
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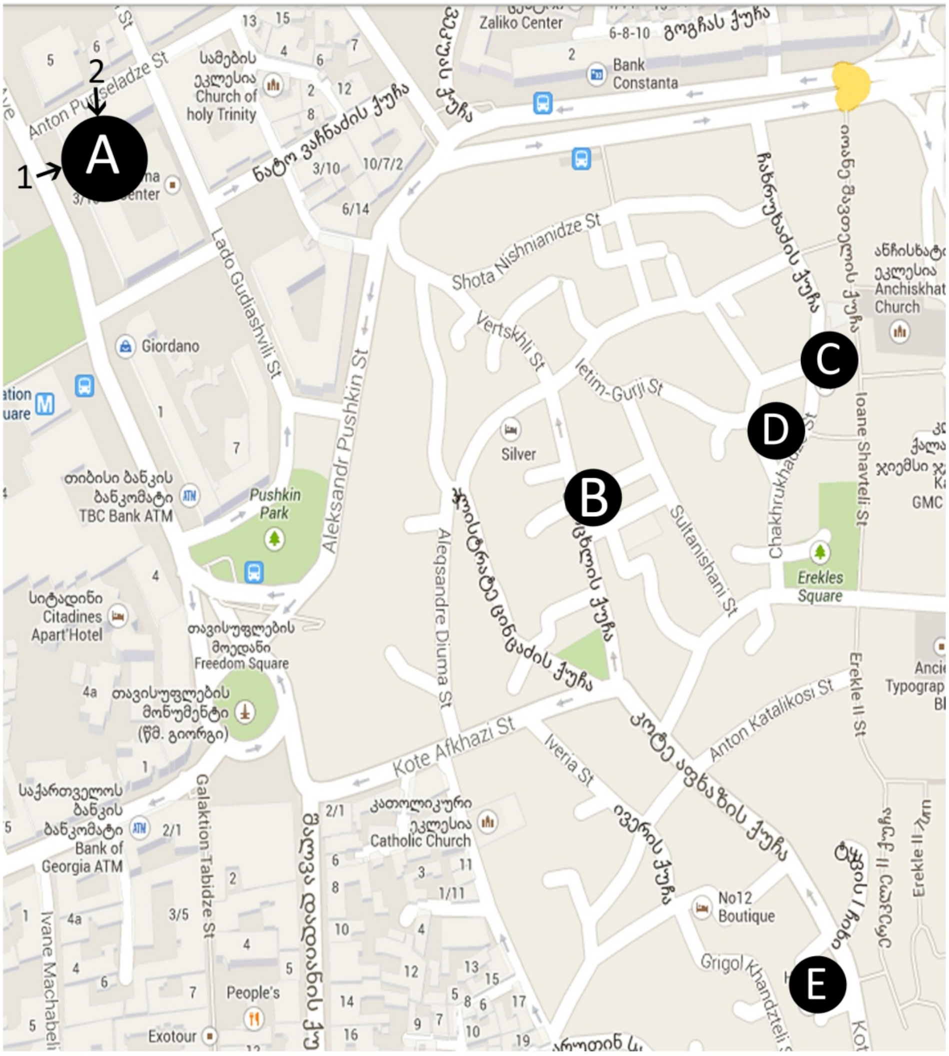

A Georgian National Museum
B SkadaVeli
C Charm Hotel
D Villa Mtiebi
E Hotel VIP

1 - main entrance, Rustaveli Aven. 3
2 - side entrance, Purtseladze Street 1

GENERAL PROGRAM

Tuesday 15.10.	19:00 - 20:00 Registration at the National Museum (main entrance, Rustaveli Aven. 3) 19:00 - 21:00 Welcome Reception at the National Museum
Wednesday 16.10.	09:00 - 10:00 Registration at the National Museum in front of the lecture hall (side entrance, Purtseladze Street 1) 10:00 - 18:00: Workshop sessions (lecture hall)
Thursday 17.10.	10:00 - 18:00: Workshop sessions (lecture hall)
Friday 18.10.	10:00 - 13:30: Workshop session and general discussion (lecture hall) 16:00 - 19:00: Visit of the *Giorgi Chitaia Open Air Museum of Ethnography* from 19:00: Conference Dinner at the Restaurant *Rachis Ubani* in the Open Air Museum Transport will be provided from and to the National Museum
Saturday 19.10.	from 10:00: Excursion to Dmanisi Transport will be provided from and to the National Museum

WEDNESDAY 16.10.2013

10:00 David Lordkipanidze

Welcome and general introduction to the aims of the workshop

10:30 Angela Bruch

Introduction to ROCEEH and the VW Caucasus projects

WORKSHOP SESSION I

DMANISI: THE FIRST OUT OF AFRICA - WHAT DO WE KNOW? WHAT DO WE NEED?

11:00 Oriol Oms and Reid Ferring

Magnetostratigraphic Constraints in the Dating of the Dmanisi Sites (Caucasus)

11:30 - 12:00 Coffee break

12:00 Abesalom Vekua

The Hominids of Dmanisi and Their Environment

12:30 Nikoloz Tsikaridze, F. Carotenuto, Pasquale Raia, and Lorenzo Rook

Homo erectus Dispersal Patterns for the Out-of-Africa 1 Model and Dmanisi Archaeological Site

13:00 Martha Tappen

A Taphonomic View of Site Formation and Interactions Between Early Homo and the Mammals from Dmanisi

13:30 – 14:30 Lunch break

14:30 Jordi Agustí, Hugues-Alexandre Blain, Massimo Delfino, Alexander Mouskhelishvili, Marc Furió, and David Lordkipanidze

Paleoenvironmenal and Climatic Context of Dmanisi Based on Small Vertebrates

15:00 Reid Ferring and Teona Shelia

Variability and Change in the Record of Occupations in Block M5 at Dmanisi

15:30 Laura Longo

Tools Use and Foraging Behavior at Dmanisi (Georgia)

16:00 - 16:30 Coffee break

WORKSHOP SESSION II

EARLY PLEISTOCENE ENVIRONMENTAL CHANGES IN SOUTHERN CAUCASUS

16:30 Maia Bukhsianidze and Christine Hertler

Large Mammals from the Akhalkalaki Site

17:00 Christine Hertler and Maia Bukhsianidze

Ecological Structure and Diversity of the Specialized Herbivore Community at Akhalkalaki

17:30 Eliso Kvavadze, Steffen Scharrer, Ivan Gabrielyan, Maia Bukhsianidze, Rusudan Chagelishvli, and Angela A. Bruch

Non-Pollen Palynomorphs in Early Pleistocene Lake Sediments of the Southern Transcaucasus and Their Importance for Climatic Reconstruction

THURSDAY, 17.10.2013

10:00 Uwe Kirscher, Oriol Oms, Angela A. Bruch, and Valerian Bachtadse

New Magnetostratigraphic Correlation of Major Outcrops of the Guria Sequence, Western Georgia

10:30 Irina Shatilova

The History of Western Georgia's Vegetation During the Pleistocene

11:00 Ivan Gabrielyan

Macroflora of the Sisian Formation: Fossils and Their Nearest Living Relative Plant Communities

11:30 - 12:00 Coffee break

12:00 Margharet A. Marjanyan and R. G. Harutyunyan

On the Paleofauna of Acrididae (Orthoptera) and Curculionidae (Coleoptera) of the Diatomaceous Sediments of Southern Armenia (Early Pleistocene, Sisian Suite)

12:30 Michael Märker, Felix Bachofer, Geraldine Quènèhervè, and Volker Hochschild

Multi-Spectral Analysis of Landscape Patterns in the Vorotan River Basin

13.00 Angela A. Bruch, Ivan Gabrielyan, Steffen Scharrer, and Vasilis Teodoridis

Early Pleistocene Environmental Changes in the Southern Caucasus – Climate and Vegetation at the Time of Early Human Expansion into Eurasia

13:30 – 14:30 Lunch break

WORKSHOP SESSION III

SOUTHERN CAUCASUS PALAEOLITHIC: OCCURRENCE AND CO-OCCURRENCE OF NEANDERTHALS AND THE FIRST AMHS / ENVIRONMENTAL CONSTRAINS OF THE SOUTHERN CAUCASUS PALAEOLITHIC

14:30 Boris Gasparyan

Newly Discovered Paleolithic Sites of Armenia: Achievements and Perspectives

15:00 Daniel S. Adler, K.N. Wilkinson, S. Blockley, D. Mark, Ron Pinhasi, B. Schmidt, B. Yeritsyan, E. Frahm, and Boris Gasparyan

Earliest Evidence for Levallois Technology and the Transition from the Lower to Middle Paleolithic in the Caucasus: New Data from Nor Geghi 1, Armenia

15:30 Charles P. Egeland, Boris Gasparyan, Cynthia Fadem, Dmitri Arakelyan, Christopher Miller, Samvel Nahapetyan, Simon Armitage, and Christopher M.Nicholson

Middle Paleolithic Occupations in the Debed River Valley (Lori Depression, Northeastern Armenia)

16:00 - 16:30 Coffee break

16:30 Ethel Allué

The Study of Past Vegetation and Plant Resource Use Based on Charcoal Analyses from Middle and Upper Pleistocene Sites in the Southern Caucasus

17:00 Andrew Kandel and Boris Gaspayan

Cultural Adaptations in the Southern Caucasus: Early Evidence for Clothing from Aghitu-3 Cave, Armenia

17:30 Lior Weissbrod and Guy Bar-Oz

New Data on Late Pleistocene Geographic Variation Among Faunal Communities of the Southern Caucasus

FRIDAY, 18.10.2013

10:00 Ofer Bar-Yosef, Anna Belfer-Cohen, Z. Matskevich, T. Meshveliani, and N. Jakeli

Dating the Upper Paleolithic and Mesolithic in Western Georgia

10:30 Volker Hochschild, Michael Märker, Geraldine Quènèhervè, and Zara Kanaeva

ROAD – A Web-Based Spatial Information System for the Visualization of Early Human Environments

11:00 David Lordkipanidze

Dmanisi: The first Out of Africa - what do we know? what do we need?

11:30 - 12:00 Coffee break

12:00 - 13:30 GENERAL DISCUSSION

POSTER PRESENTATIONS I

DMANISI: THE FIRST OUT OF AFRICA - WHAT DO WE KNOW? WHAT DO WE NEED?

Medea Nioradze and Giorgi Nioradze

Early Paleolithic Site of Dmanisi and its Lithic Industry

POSTER PRESENTATIONS II

EARLY PLEISTOCENE ENVIRONMENTAL CHANGES IN SOUTHERN CAUCASUS

Rusudan Chagelishvili and Maia Bukhsianidze

Quaternary Fluvio-Lacustrine Sediments and Fossil Vertebrate Sites of the Akhalkalaki Plateau (Southern Georgia)

Inga Martkoplishvili, Eliso Kvavadze, Rusudan Chagelishvili, Maia Bukhsianidze, and Angela A. Bruch

Non-Pollen Palynomorphs in the Pleistocene Pollen Spectra of Javakheti Plateau (Southern Georgia)

Abesalom Vekua, Manana Gabunia, Maia Bukhsianidze, and Rusudan Chagelishvili

Discovery and Research History of the Akhalakalaki Site

Dmitri Arakelyan

The Basement Rocks Beneath the Sisian Formation (Southern Armenia)

Laura D. Harutyunova

Early Pleistocene Freshwater and Terrestrial Molluscs from Southern Armenia

Flora A. Hayrapetyan

Ostracods from the Halidzor Section

Samvel Pipoyan

The Modern Ichthyofauna of Vorotan River System

Samvel Pipoyan and Davit Vasilyan

Representatives of Fossil Fishes from Vorotan River Basin

Tanja Rutz, Angela A. Bruch, and Irina Shatilova

Early Pleistocene Environmental Changes in Southern Caucasus – Reconstruction of Climate and Vegetation Development in Western Georgia During the Gurian Stage

Steffen Scharrer, Angela A. Bruch, and Ivan Gabrielyan

Early Pleistocene Environmental Changes in Southern Caucasus – High-Resolution Vegetation Reconstruction in Southern Armenia During the Mid-Pleistocene Transition

Alla Hayrapetyan

Palynomorphological Investigation of the Genus Quercus L.

POSTER PRESENTATIONS III

SOUTHERN CAUCASUS PALAEOLITHIC: OCCURRENCE AND CO-OCCURRENCE OF NEANDERTHALS AND THE FIRST AMHS / ENVIRONMENTAL CONSTRAINS OF THE SOUTHERN CAUCASUS PALAEOLITHIC

Tania King, Ethel Allué, P. Andrews, L. Asryan, M. Barham, I. Cáceres, P. Domínguez-Alonso, Y. Fernández-Jalvo, S. Hixson Andrews, E. Lynch, A. Mardiyan, M.D. Marín-Monfort, N. Moloney, J. Murray, J. Van der Made and L. Yepiskoposyan

Renewed Excavations at the Middle Pleistocene to Holocene Complex of Azokh Cave, Lesser Caucasus

Nina Manaseryan and Laura Harutyunova

Biodiversity of a Holocene Faunal Assemblage from Lake Sevan (Armenia)

Medea Nioradze and Giorgi Nioradze

A Sculptural Image of Palaeolithic Women from Okumi Cave

Nikoloz Tushabramishvili

The Role of the Western Georgian Refuge Zone on Expansion of Neanderthals and Anatomically Modern Humans: Impact of Tectonic and Volcanic Processes on Human Beings During the Middle and Upper Paleolithic

ABSTRACTS

of

ORAL

Contributions

in alphabetical order

Earliest Evidence for Levallois Technology and the Transition from the Lower to Middle Paleolithic in the Caucasus: New Data from Nor Geghi 1, Armenia

Daniel S. Adler [1], K.N. Wilkinson [2], S. Blockley [3], D. Mark [4], Ron Pinhasi [5], B. Schmidt [1], B. Yeritsyan [6], E. Frahm [7] and Boris Gasparyan [6]

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[2] Department of Archaeology, University of Winchester, Winchester, UK
[3] Department of Geography, Royal Holloway, University of London, UK
[4] ERC Argon Isotope Facility, Scottish Universities Environmental Research Center, Scottish Enterprise and Technology Park, UK
[5] School of Archaeology, University College Dublin, Ireland
[6] Institute of Archaeology and Ethnology, National Academy of Sciences of the Republic of Armenia, Yerevan, Armenia
[7] Department of Archaeology, University of Sheffield, UK

The late Middle Pleistocene (OIS 11-5e, ca. 400-130 ka) is a period of profound human biological, behavioral, and cultural change that witnessed the evolution of early modern humans in Africa and the Neanderthals in Europe. Within Africa this biological shift is accompanied by the transition from the late Acheulian to the Middle Stone Age, which can be best characterized as the gradual technological replacement of handaxes and bifaces by points and blades produced through the Levallois method. A similar technological trend characterizes the beginning of the Middle Paleolithic in Europe, especially after 300 ka (OIS 8) when Levallois technology emerges across much of the continent largely in tandem with the appearance of Neanderthal morphological traits in the fossil record. Contemporaneous archaeological sites in the Levant assigned to the Acheulo-Yabrudian complex document this transition with the systematic production of blades and Quina scrapers and the disappearance of handaxes. However, within the Southern Caucasus, a pivotal geographic region between Africa, the Levant, and Europe, virtually nothing is known about the archaeological record of this period.

Here we report on recent research at Nor Geghi 1 (NG1), an in situ open-air site contained within floodplain sediments that provides new data pertaining to this poorly understood period of human biological and behavioral flux. The well-dated lithic artifacts from a buried paleosol within the alluvial strata document the variable technological behaviors of the site's late Middle Pleistocene occupants (prior to and including OIS 9c) and chart the local transition from the late Lower Paleolithic (Mode 2, bifaces via façonnage) to the early Middle Paleolithic (Mode 3, core and flake via Levallois). Preliminary data suggest that NG1 represents the oldest directly dated appearance of a late Middle Pleistocene transitional industry with Levallois technology recovered from a secure archaeological context. Comparisons with contemporaneous data from Africa, the Levant and Europe indicate that this technological transition occurred quite early in the Southern Caucasus. While the hominin species involved in this local technological transition cannot be identified due to a lack of fossil material, we argue that the intercontinental transition from Mode 2 to Mode 3 technologies occurred intermittently within different geographically dispersed hominin societies already adept at complex knapping procedures and was not predicated on the demic diffusion of a particular species armed with Mode 3 technology.

The Study of Past Vegetation and Plant Resource Use Based on Charcoal Analyses from Middle and Upper Pleistocene Sites in the Southern Caucasus

Ethel Allué [1,2]

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[2] Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain

Archaeobotanical macro-remains studies from Paleolithic sites are generally scarce due to poor preservation of the organic material and sometimes the lack of appropriate sampling. The most commonly recovered materials are charcoal remains that are usually sampled for dating purposes. However, using anthracological methods, it has become possible to study charcoal remains, which permits the study of past environment and plant use. Anthracology has two research approaches: on the one hand, the palaeoenvironmental approach permits us to understand aspects of local woody vegetation; on the other hand, charcoal remains are a product of human activities related to fire maintenance and allow us to define gathering patterns among hunter-gatherers. Until now, there are few studies based on anthracological analyses of Pleistocene sites in the Caucasus, so that new contributions are important to provide new data on both aspects.

The aim of this work is to present the results of the charcoal remains from Azokh Cave (Nagorno-Karabagh) and Lusakert Cave (Armenia). Recent excavations carried out at Azokh Cave (Fernández-Jalvo et al., 2010; Murray et al., 2012; Allué, in progress) and Lusakert Cave (see Adler, this volume) have permitted the recovery and the study of the charcoal remains. At Azokh 1 Cave a total of 886 charcoal fragments from Unit II and Unit V-upper have been studied. These units correspond to a chronology between ca. 100-200 ka (Fernández-Jalvo et al., 2010). The results of the anthracological study show a record with up to nine taxa, including variability within the identified genus or types. The most abundant taxa is *Prunus* which represents 80% of the record. The rest of the taxa, among which there are species such as *Acer*, Maloideae and *Quercus* ssp. deciduous, show lower values. This plant assemblage reflects mild and humid environmental conditions and could suggest a pioneer succession or a pre-forest plant community leading to a deciduous oak forest. Lusakert Cave has yielded 53 charcoal remains from four Paleolithic layers. The results show different taxa such as *Prunus*, *Hippophae*, *Fagu*s and *Punica*, among others. These results show differences in their presence-absence along the sequence, providing preliminary information on plant communities and environmental conditions near the site.

References:

Fernández-Jalvo, Y., King, T., Andrews, P., Yepiskoposyan, L., Moloney, N., Murray, J., Domínguez-Alonso, P., Asryan, L., Ditchfield, P., van der Made, J., Torres, T., Sevilla, P., Nieto Díaz, M., Cáceres I., Allué, E., Marín Monfort, M.D., Sanz Martín, T. 2010. The Azokh Cave complex: Middle Pleistocene to Holocene human occupation in the Caucasus. *Journal of Human Evolution* 58(1):103-109.
Murray, J., Domínguez-Alonso, P., Fernández-Jalvo, Y., King, T., Lynch, E.P., Andrews, P., Yepiskoposyan, L., Moloney, N., Cacères, I., Allué, E., Asryan, L., Ditchfield, P., Williams, P. 2010 Pleistocene to Holocene stratigraphy of Azokh 1 Cave, Lesser Caucasus. *Irish Journal of Earth Sciences* 28 (2010): 75–91.
Allué, E. (in progress). Charcoal remains from Azokh 1 Cave (Azokh, Nagorno-Karabagh). A study on past vegetation and firewood management among Paleolithic hunter-gatherers. In: Fernández-Jalvo, Y. Andrews, P. King, T. Yepiskoposyan, L. (eds.). *Azokh Cave and the Transcaucasian Corridor*.

Paleoenvironmenal and Climatic Context of Dmanisi Based on Small Vertebrates

Jordi Agustí[1], Hugues-Alexandre Blain[2], Massimo Delfino[3], Alexander Mouskhelishvili[4], Marc Furió[5], David Lordkipanidze[4]

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[3] Dipartimento de Scienze della Terra, Università di Torino, Torino, Italy
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[5] Institut Català de Paleontologia, Mòdul ICP, Universitat Autònoma de Barcelona, Barcelona, Spain

In this paper we analyze the environmental context of the Dmanisi hominids from the point of view of the small vertebrates. Among the small mammals this includes rodents and insectivores. From the paleoherpetological record this includes amphibians and squamates. The dominant elements in Dmanisi are steppic rodents of Levantine affinities (almost 70% of the sample). Both *Parameriones* aff. *obeidiensis* and *Cricetulus* n. sp. can be related to species that have been found at the Lower Paleolithic site of Ubeidiya. In contrast, typical European elements (arvicolids of the genus *Mimomys* and the murid *Apodemus* aff. *dominans*) are less common (30%). Among these, with the exception of *Allocricetus bursae* (which is considered as an eastern element by some authors), these European elements are usually associated with wooded or humid habitats. Therefore, the rodent association from Dmanisi suggests an open, steppic environment, although the scarce arvicolid and murid representation would indicate the presence of wooded areas not far away from this steppic landscape. This context is also supported by the presence of the venomous shrew, *Beremendia fissidens*, well adapted to survive during periods of stress. Climatic conditions inferred from the paleoherpetological data also support an environment more arid that the present conditions in the area.

Dating the Upper Paleolithic and Mesolithic in Western Georgia

Ofer Bar-Yosef[1], Anna Belfer-Cohen[2], Z. Matskevich, T. Meshveliani, N. Jakeli

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The excavations at Dzudzuana Cave and the rockshelters of Kotias Klde and Ortvale Klde in the region of Chiatura enabled us to recognize and date the basic cultural sequence of the Upper Paleolithic and Mesolithic in this region. In spite of several gaps in the stratigraphy of Dzudzuana and Kotias Klde, we managed to obtain two series of radiocarbon dates that when added to the dates from Ortvale Klde provide, for the first time, a sound chronological framework for local prehistoric occupations during those periods. Taking the range of calibrated BP dates with 1 SD the following sequence emerges. The earliest Upper Paleolithic occurrence is dated in Ortvale Klde to ca. 40/38-32/31 ka cal BP (Adler et al. 2008), in Dzudzuana to ca. 37/35-32/31 ka cal BP and in Kotias Klde to ca. 29-27 ka cal BP. This early UP entity is a blade and bladelet industry with a few bone tools. The proceeding industry, recovered in Dzudzuana and Kotias Klde is characterized by carinated cores and numerous retouched bladelets, bone and antler artifacts, including a few pendants and other ornaments, and is dated to ca. 27/26-24/23 ka cal BP. There is a chronological gap and the next industry is the Epi-Gravettian with numerous microgravette points, and an opposed blade core technique, dated to ca. 17/16-13 ka cal BP. This industry was recovered only in Dzudzuana Cave. Traditionally considered as representing the local Mesolithic, the following industry demonstrates a proliferation of scalene triangles often shaped by bi-polar retouch. It was recovered in Kotias Klde, though there were a few items indicating that it was present also in Dzudzuana, and is dated to ca. 12-11.5 ka cal BP. We note that the Upper Paleolithic sequence from the foothills of the Southern Caucasus correlates well, in terms of contents and dates, with that of the site of Mezmaiskaya on the northern slopes of the Caucasus.

Early Pleistocene Environmental Changes in the Southern Caucasus – Climate and Vegetation at the Time of Early Human Expansion into Eurasia

Angela A. Bruch[1], Ivan Gabrielyan[2], Steffen Scharrer[1], Vasilis Teodoridis[3]

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[2] Institute of Botany, Armenian National Academy of Sciences, Yerevan, Armenia
[3] Department of Biology and Environmental Studies, Faculty of Education, Charles University in Prague, Czech Republic

The Southern Caucasus is the area of earliest human occupation in Eurasia, proven by findings of *Homo* fossils in Georgia with an age of ca. 1.8 Ma. The pace and causes of the early human colonization, in one or several migratory waves from Africa into new environments of the Eurasian continent during the Early Pleistocene, are still a matter of debate. However, climate change is considered a major driving factor of hominin evolution and dispersal patterns. In fact climate modulates the availability of resources directly or indirectly by means of its severe influence on vegetation, physiography of landscape, and animal distribution.

To understand the Early Pleistocene local environments in the Southern Caucasus as prerequisites for the first appearance of humans in this area, we focus on vegetation and climate reconstructions based on plant fossils in an area and for a time span (2-1 Ma) known to be inhabited by early humans. By comparing short-term vegetation changes during different climatic events and in different regions, it will be possible to understand the mechanisms of climatic influence on the local vegetation, to “translate” the global climatic signal to the local setting, and to extrapolate it even to phases lacking a fossil record. Especially in the Southern Caucasus with its strong relief, it is crucial to understand altitudinal and spatial differentiation of vegetation units and their shifts with climate change. Therefore, we chose three regions for comparison and correlation: the Southern Armenian highlands, the Southern Georgian highlands, and the western Georgian lowlands.

Southern Armenian data show species compositions with strong relations to Euxinian and Hyrcanian forests occurring today along the coasts of the Black and Caspian Seas, respectively, which must have expanded during warmer and more humid periods of the Early Pleistocene. Climate quantifications indicate a warming of at least 5° C and 50-100% more humid conditions for the most pronounced interglacials. Based on these results we extrapolate the distribution of forests and mosaic landscapes in the Southern Caucasus for different climatic phases during the Early Pleistocene as a prerequisite for the reconstruction of early human environments in this region.

Large Mammals from the Akhalkalaki Site

Maia Bukhsianidze[1], Christine Hertler[2]

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The fauna from Akhalkalaki (Southern Georgia) dating between 0.98-0.78 Ma document the Villafranchian-Galerian transition. This paper presents the results of our reorganization and revision of the Akhalkalaki fossil collection.

As a result of our revisions to the faunal list, we made some changes, mainly in terms of the Artiodactyla. Bovidae comprise the following taxa: *Bison* sp., *Capra* sp., Caprinae indet. and *Pontoceros ambiguous*. The affinity of the Akhalkalaki cervid identified as *Praemegaceros verticornis* is doubted based on dental and postcranial characteristics, as no cranial or antler fragments are known from the fossil assemblage. *Hippopotamus georgicus* is similar to *H. antiquus*. The Akhalkalaki canid, *Canis tengisii*, reveals a close affinity to *C. arnenisis*.

Presence of some taxa mentioned in previous works such as *Lepus europaeus, Vulpes vulpes, Felis silvestris, Cervus* cf. *Dama* could not be confirmed, probably due to the complicated history of the collection itself.

Middle Paleolithic Occupations in the Debed River Valley (Lori Depression, Northeastern Armenia)

Charles P. Egeland[1], Boris Gasparyan[2], Cynthia Fadem[3], Dmitri Arakelyan[4], Christopher Miller[5], Samvel Nahapetyan[6], Simon Armitage[7], Christopher M.Nicholson[8]

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[5] Institute for Archaeological Sciences, University of Tuebingen, Germany
[6] Faculty of Geography, Yerevan State University, Armenia
[7] Department of Geography, Royal Holloway University of London, UK
[8] Department of Civil and Architectural Engineering, University of Wyoming, USA

Open-air, *in situ* Middle Paleolithic (MP) sites are very rare in the Lesser Caucasus, and the MP occupation of Armenia’s Debed River Valley of northern Armenia is virtually unknown. This paper outlines recent survey for and excavations of several open-air MP sites. A total of 21 MP occurrences have been discovered thus far, and two in particular, Bagratashen 1 and Ptghavan 4, appear to preserve *in situ* occupations. Both sites are located in terrace sediments of the Debed and suffered little post-depositional disturbance. At Bagratashen 1, test excavations have revealed a dense (126 finds/cubic meter) and well-preserved lithic collection from a discrete horizon. Typologically, the lithics signal an early MP occupation. A handaxe discovered during surface survey may indicate a Late Acheulean component as well. At Ptghavan 4, a dense, *in situ* MP assemblage that likely postdates the occupation at Bagratashen 1 has been recovered. Based on these data, we feel that the Lori Depression can play a significant role in understanding MP settlement dynamics and adaptations in the Southern Caucasus and beyond.

Variability and Change in the Record of Occupations in Block M5 at Dmanisi

Reid Ferring [1] and Teona Shelia [2]

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Block M5 at Dmanisi is situated upslope and about 90 m from the main excavations in Blocks 1-2. Block M5 preserves just over 7 m of stratified deposits overlying the Masavera Basalt, divided into ascending Strata A1-A4, B1-B5, and C. The Olduvai-Upper Matuyama reversal is at the A-B contact. Three seasons of excavation in the 25 square meter block recovered lithic artifacts from every stratum (n=930), and fauna from strata A2, A4 and B1-B4. The materials from Stratum A, dated between 1.85-1.78 Ma, are the oldest in Eurasia, while those from Stratum B add to the record established in other excavation areas. The M5 archaeology registers numerous serial occupations of the Dmanisi promontory, indicating a well-established adaptation to the region by a mobile population. Stratum A assemblages are dominated by intensively reduced tuff raw materials, with a high production of small flakes. Stratum B1, which in other blocks contains all of Dmanisi's *Homo erectus* fossils, has assemblages indicating a shift to low intensity/high frequency occupations, associated with expedient core reduction, and higher variability in raw material selection. Four carnivore dens dug from Stratum B1, contain numerous gnawed bones and coprolites, attesting to penecontemporaneous use of the promontory by hominins and carnivores, associated with a high chance of confrontation. The materials from Strata B2-C indicate continued low frequency/intensity occupations. Overall, the new data from M5 provide one of the most detailed records of occupation patterns by earliest *Homo*, as well as insights into their adaptation to temperate Eurasia.

Macroflora of the Sisian Formation: Fossils and Their Nearest Living Relative Plant Communities

Ivan Gabrielyan

Institute of Botany, National Academy of Sciences of the Republic of Armenia, Yerevan, Armenia

Based on fossil leaf imprints about 125 taxa of higher plants have been identified from the Sisian Formation. Their modern equivalents represent a wide range of biomorphs comprising trees, shrubs, shrublets, semishrubs, and terrestrial and aquatic herbs. Identification of the plant remains continues and is expected to reach 170 taxa. Greatest attention was paid to the accurate determination of taxa. Based on these results, the taxa were grouped into 19 plant communities using the Nearest Living Relative comparative approach:

Aquatic communities:

1. Communities of free floating fresh water plants – *Lemna* cf. *trisulca*, *Ceratophyllum* cf. *demersum*, *C.* cf. *submersum*, etc.;
2. Communities of ground established fresh water plants – *Myriophyllum* cf. *spicatum*, *Potamogeton* cf. *crispus*, *P.* cf. *coloratus*, *P.* cf. *natans*, *P.* cf. *perfoliatus*, *P.* cf. *pectinatus*, *Groenlandia* cf. *densa*, *Polygonum* cf. *amphibium*, etc.;
3. Semi-aquatic vegetation – *Equisetum* sp., *Phragmites* cf. *australis*, *Carex* cf. *bohemica*, *Juncus* cf. *articulatus*, etc.;
4. Marshy vegetation – *Osmunda* cf. *regalis*, *Thelypteris* cf. *palustris*, *Carex* cf. *bohemica*, etc.;

Arid light forest (open forest) vegetation:

5. Juniper coniferous arid light forest – *Juniperus* cf. *polycarpos*, *Amelanchier* cf. *ovalis*, *Berberis* cf. *vulgaris*, *Lonicera* cf. *iberica*, *Spiraea* cf. *crenata*, *Cotoneaster* sp., *Rosa* sp., *Thymus* cf. *kotschyanus* ;
6. Pistachio broad-leaved arid light forest – *Pistacia* sp., *Acer* cf. *ibericum*, *Punica* cf. *granatum*, *Lonicera* cf. *iberica*, *Thymus* cf. *kotschyanus*, *Salsola* sp., *Alyssum* sp., etc.;
7. Celtis broad-leaved arid light forest – *Celtis* cf. *caucasica*, *Acer* cf. *ibericum*, *Punica* cf. *granatum*, *Prunus* cf. *divaricate*, *Fraxinus* sp., *Ulmus* sp., *Lonicera* cf. *iberica*, *Spiraea* cf. *crenata*, etc.;
8. Paliurus broad-leaved arid light forest (Shibliak) – *Paliurus* cf. *spina-christi*, *Acer* cf. *ibericum*, *Punica* cf. *granatum*, *Cotinus* cf. *coggygria*, *Berberis* cf. *vulgaris*, *Spiraea* cf. *crenata*, *Crataegus* sp., *Nepeta* cf. *mussinii*, etc.;
9. Oak broad-leaved arid light forest – *Quercus* cf. *infectoria*, *Juniperus* cf. *polycarpos*, *Cotinus* cf. *coggygria*, *Colutea* sp., *Crataegus* sp., *Rosa* sp., etc.;
10. Oak broad-leaved arid light forest (Maquis, Mediterranean basin) – *Quercus* cf. *ilex*, etc.;
11. Oak broad-leaved arid light forest (Maquis, Cyprus type) – *Quercus* cf. *alnifolia*, etc.;
12. Pear broad-leaved arid light forest – *Pyrus* cf. *syriaca*, *Cotinus* cf. *coggygria*, *Sorbus* cf. *graeca*, *Crataegus* sp., *Cotoneaster* sp., *Rosa* sp., etc.;

Broad-leaved forest vegetation:

13. Riverside broad-leaved forest – *Populus* cf. *alba*, *P.* cf. *nigra*, *Ulmus* cf. *minor*, *Salix* cf. *alba*, *S.* cf. *excelsa*, *S.* cf. *triandra*, *S.* cf. *wilhelmsiana*, *Hippophae* cf. *rhamnoides*, *Periploca* cf. *graeca*, etc.;
14. Oak broad-leaved forest – *Quercus* cf. *iberica*, *Carpinus* cf. *betulus*, *Acer* cf. *cappadocicum*, *Zelkova* cf. *carpinifolia*, *Cerasus* cf. *avium*, *Cornus* cf. *mas*, *Corylus* sp., *Lonicera* cf. *caucasica*, *Malus* cf. *orientalis*, *Prunus* cf. *divaricate*, *Viburnum* cf. *lantana*, etc.;
15. Oak broad-leaved forest – *Quercus* cf. *macranthera*, *Carpinus* cf. *betulus*, *Acer* cf. *hyrcanum*, *A.* cf. *platanoides*, *Fraxinus* cf. *excelsior*, *Tilia* cf. *cordata*, *Lonicera* cf. *caucasica*, *Malus* cf. *orientalis*, *Salix* cf. *caprea*, *Viburnum* cf. *lantana*, etc.;
16. Oak broad-leaved forest – *Quercus* cf. *castaneifolia*, *Q.* cf. *cerris*, *Acer* cf. *velutinum*, *Zelkova* cf. *carpinifolia*, *Tilia* cf. *begoniifolia*, *Viburnum* cf. *lantana*, etc.;
17. Upper zone of forest vegetation – *Betula* cf. *pendula*, *B.* cf. *pubescens*, *Acer* cf. *heldreichii* ssp. *trautvetteri*, *Populus* cf. *tremula*, *Salix* cf. *caprea*, *Ribes* cf. *orientale*, *Rosa* cf. *spinosissima*, *Viburnum* cf. *lantana*, etc.;

Open landscape vegetation:

18. Semi-desert vegetation – *Calligonum* cf. *polygonoides*, *Salsola* sp., *Halanthyum* sp. (Akopyan et all., 2008), *Alyssum* sp., etc.;
19. Desert bushes – *Spiraea* cf. *crenata*, *S.* cf. *hypericifolia*, etc.

As for other types of open landscape vegetation communities (steppe, meadow, etc.) it is possible that they were more widespread in the Early Pleistocene than reflected by this list. This is evidenced by a number of findings of fruits and seeds from Asteraceae, Apiaceae, Fabaceae, Brassicaceae, Lamiaceae, and other families. However, taphonomic conditions do not usually allow these types of plants to enter the fossil record. Therefore, fossil leaf flora as expressed by trees, shrubs and aquatic plant remains are better indicators.

Newly Discovered Paleolithic Sites of Armenia: Achievements and Perspectives

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The territory of the Republic of Armenia is situated at the very core of an area that will prove critical for understanding the Paleolithic settlement of the Southern Caucasus and beyond. Although Soviet-era archaeologists reported numerous Paleolithic sites in the country, most of their research is published in either Armenian or Russian and is thus poorly known to Western scholars. For this reason, earlier results do not significantly affect the recent regional and pan-regional syntheses. While this is certainly regrettable, the fact is that the Armenian Paleolithic suffers from the same deficiencies as those cited for the Southern Caucasian record in general: namely a lack of well-excavated, *in situ* sites. A new wave of research is now beginning to lay a robust theoretical, chronological, and paleoenvironmental foundation for the county’s Paleolithic settlement. Through joint projects of the last decades, numerous Lower, Middle and Upper Paleolithic sites were discovered and studied in the Republic of Armenia, some of which are of high regional importance. This presentation will focus mainly on a general description of the recently excavated sites and their chronological and cultural significance. Following this, presentations and discussions of the study results from some of the above-mentioned sites will provide further details.

Ecological Structure and Diversity of the Specialized Herbivore Community at Akhalkalaki

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Previous reconstructions described the paleoenvironment at Akhalkalaki as a dry warm meadow-steppe (Vekua 1962, 1987) influenced by montane conditions including nearby permanent bodies of water (Hemmer et al. 2001). The descriptive interpretations are based on general considerations of the composition of the fauna and the quantitative dominance of *Equus suessenbornensis*. In order to examine the ecological structure of the large mammal community at Akhalkalaki on a quantitative basis, we assessed a suite of ecological variables, for instance body mass and diet.

Our study focuses on the specialized herbivore community. The ecological structure of the sample is dominated by high abundances based on NISP of *E. suessenbornensis*. It provides a strong specialized grazing signal. However, the diversity among the fresh grass grazers is higher, because five species contribute to the signal. Abundances in the body mass spectrum are similarly dominated by *E. suessenbornensis*. This equid is comparatively large with an average body mass of 642 kg in the assemblage and dominates abundance-based size distributions. This has implications for the carnivore guild. In order to be capable of hunting prey of the well occupied size class 4b (500-1,000 kg), a solitary hunting predator needs to be quite large or adopt a pack hunting strategy.

For a model-based interpretation of the paleoenvironment, particularly with respect to climate and features of vegetation, we established a reference sample based on datasets from 35 national parks located between 30-60°N latitude and 15-70°E longitude. The reference sample represents seven biomes in sub-tropical and temperate climate zones. It correlates three basic datasets, namely the ecological diversity of the large herbivore fauna, temperature, precipitation and seasonality in both subsets, as well as data on vegetation density and plant primary productivity. We distinguish among six categories of specialized herbivore communities, which differ in ecological structure and diversity and are associated with specific climate regimes and vegetation patterns.

A quantitative comparison of the ecological structure and diversity of the specialized herbivore community in the Akhalkalaki assemblage illustrates that similar faunas are presently found in temperate latitudes and are associated with the temperate mixed broad-leaved forest rather than temperate conifer forests, forest steppe, alpine tundra or other systems at high altitudes. Although the name implies a forested and thus dense type of vegetation, our reference dataset includes a variety of vegetation densities.

References:

Hemmer, H., Kahlke, R.-D., Vekua, A. K. (2001): The Jaguar, *Panthera onca gombaszoegensis* (Kretzoi, 1938) (Carnivora: Felidae) in the late Lower Pleistocene of Akhalkalaki (South Georgia; Transcaucasia) and its evolutionary and ecological significance. Geobios 34: 475-486.

Vekua, A. K. (1962): Akhalkalakskasja Niznepleistozenovaja Fauna Mlekopitaioshih. Tbilisi, SSR.

Vekua, A. K. (1987). The Lower Pleistocene mammalian fauna of Akhalkalaki (Southern Georgia, USSR). Palaeontographia Italica 74: 65-96.

ROAD – A Web-Based Spatial Information System for the Visualization of Early Human Environments

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The assessment of early human expansions in a spatial, cultural and biological context must be supported with a variety of spatial datasets including variables and formats from different scientific sectors in vector, raster and text formats. Consequently, sophisticated georelational spatial information systems are normally applied to handle the required information. In this paper we focus especially on the spatial data and their visualization. Therefore, we illustrate the technical prerequisites such as the PostGIS open source software enhancement and the related web map services. Moreover, we show how the data can be elaborated with a full GIS system even on a web platform. This will enable the professional mapping and illustration of early human environments.

Cultural Adaptations in the Southern Caucasus: Early Evidence for Clothing from Aghitu-3 Cave, Armenia

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New finds from Aghitu-3 Cave, layer IIId, in southern Armenia indicate that the Upper Paleolithic inhabitants of the Southern Caucasus used eyed sewing needles and awls made of bone by about 29 ka cal BP. This evidence complements findings from Dzudzuana Cave, layer C, in Georgia, where an eyed needle, awls and flax fibers were discovered dating to 27-23 ka cal BP (see Bar-Yosef *et al.*, this volume). Such finds provide material evidence that the Upper Paleolithic people of the Caucasus sewed clothing.

Archaeological layer IIId from Aghitu-3 provides a unique snapshot into the daily lives of the earliest known Upper Paleolithic inhabitants of Armenia. In addition to the bone tools, these people produced obsidian bladelets which were then fashioned into finely retouched tools. Their hunting focused on medium sized ungulates and equids, whose shaft fragments show signs of human modification such as green breaks and impact fractures. Combustion features consisting of charcoal, ash and rubefied sediment are present. Identified botanical remains include trees and shrubs such as poplar, willow, maple, birch and sea-buckthorn. Studies of the well preserved microfauna indicate that these remains were likely accumulated by a non-selective raptor such as eagle owl. The microfauna indicate a climate that was cooler than today. Pollen data from this layer also suggest a cooler climate with a decline of the treeline and a spreading of boreal vegetation.

The archaeological finds from Aghitu-3, layer IIId, suggest that a mobile population of Upper Paleolithic people used this high altitude (1601 m) cave as a seasonal hunting camp. Based on microfauna and pollen data, the climate was humid and cooler than today. Based on charcoal remains, a temperate woodland prevailed, possibly related to the riparian corridor of the nearby Vorotan River. Thus the overall environmental picture appeared similar to today, although somewhat cooler. While the existence of clothing is not surprising given the strong seasonal nature of the climate, we see material evidence supporting the manufacture of clothing in the Southern Caucasus for the first time.

New Magnetostratigraphic Correlation of Major Outcrops of the Guria Sequence, Western Georgia

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It is generally accepted that the Caucasus region represents the major corridor through which early hominids migrated from Africa into Eurasia. This has been demonstrated by the sensational findings of hominid skulls in Dmanisi, Georgia. Since then many studies have been undertaken to establish a theory which explains and describes the reasons and patterns why and how our ancestors left their habitats in Africa. Climatic reasons are likely to be the major cause of migration, either directly or indirectly, by governing the movement of animals as the main food source.

To establish a detailed paleoenvironmental picture at the time of hominid migration we have investigated spatially distributed, high quality climate proxies. To cover the high climatic variability that occurred during the Pleistocene of this region, we require a precise age control. Sediments from the Guria sequence in western Georgia have long been known for their abundant presence of pollen. The age correlation is based on magnetostratigraphy. However, these studies do not meet present day standards of data presentation and tests of reliability.

Here we present a new magnetostratigraphic study covering two major sequences near Khvarbeti and Ziagubani. We identify mainly reversed polarities in Khvarbeti, with a small zone of normal polarity that we correlate with the Jaramillo normal polarity subchron within the Matuyama reversed chron. The topmost part of this section shows normal polarity, which might represent the Brunhes-Matuyama boundary. Ziagubani shows a more complex scenario, and may only partly be correlated to Khvarbeti. The top part is subhorizontally layered and has both normal and reversed polarities. The bottom part, ca. 80 m, is tilted and shows mainly normal polarity. The magnetic mineralogy is also different in this part. Therefore, we suggest that the top part can be correlated to the Khvarbeti section and that the bottom part is older. The bottom part might be coeval with the Olduvai or even Gauss normal chrons. Therefore, a reevaluation of the rich pollen records can be used to analyze the climate of this region from at least ca. 2.0-0.8 Ma.

Non-Pollen Palynomorphs in Early Pleistocene Lake Sediments of the Southern Transcaucasus and Their Importance for Climatic Reconstruction

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We conducted palynological investigations of Pleistocene lake sediments from profiles located in eastern Georgia and southwestern Armenia (Vorotan River Valley). Altogether we studied the material from eight profiles. With some exceptions, the material appears to be rather poor in plant pollen and spores. However, it contains large quantities of non-pollen palynomorphs (NPPs) including phytoliths, algal remains, cyanobacteria, parenchyma cells of wood, spores of various fungi, insect remains, and hair of animals.

Pollen monitoring investigations shows that changes in the composition of NPPs are related to environmental changes (Kvavadze et al. 2009; 2013). This is especially evident in the case of algae, fungi spores, mite remains and other zoological materials. The studies of lake sediments with large quantities of pollen showed that the complexes of NPPs of the layers formed during warm and cold climatic conditions differ strongly from each other. The abundance of colonies of the alga *Botryoccocus* and plant epidermis indicates a warm climate. Microsporangiums and glochidiums of the aquatic fern *Azolla* (Salviniaceae), zygospores of *Spirogyra* and *Zignema, and* colony and cysts of *Rivularia*are also reveal warm climate signals. In layers indictaing warm climatic conditions, the total content of NPP is very high. However, in layers formed under cold climatic conditions, the total NPP content is very low. Spores of the fungus *Glomus*, parenchyma cells of Coniferae wood and mineral remains signal a cold climate.

References:

Kvavadze E., Chichinadze M., Martkoplishvili I. 2009. Non Pollen Palynomorphs in trap material from Lagodekhi Reservation (Georgia). Abstracts of 7-th PMP Meeting. Taxiarchis - Chalkidiki, Greece, 17p.

Kvavadze E., Scharrer S. Martkoplishvili I., Gabrielian I., Bukhsianidze M., Chagelishvl R., Bruch A. 2013. The significance of non pollen palynomorphs investiganion of trapping material for Early Pleistocene palaeoecology in Transcaucasus area (Georgia and Armenia). Abstracts of 9-th Conference of PMP, Prague, 16 p.

Tools Use and Foraging Behavior at Dmanisi (Georgia)

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Functional analysis of the lithic assemblages from the Lower Pleistocene site of Dmanisi (Georgia) was carried out using high resolution analytical tools such as MO, SEM, as well new Digital Microscopy has been applied to a sample of lithic artefacts from M5 and Block 2 excavations (2004-2011) in order to seek for preservation state of the working edges and intentional/natural detachments recognition. On a selected samples of stone tools (circa 100) wear traces analysis had been carried out. Caution has been paid to the great variety of raw materials available for stone tool production and to their suitability for different utilizations. The analyses have a double aim of acquainting wear traces data on a large variety of different raw materials which responses strongly differ to physical stress due to the contact with the worked materials and, second, built a reference comparison with wear traces development.

Two main groups of worked material had been recognized: one related to the category of cutting tools (cutting edges tools) one connected with pounding/grinding non modified stone tools. The methodology applied is that of the High Power Approach to wear traces analysis accompanied with experimental and ethno-archeological consideration. Given to the functional analysis data, reflections had been made on the base of nutritional studies which stress the need for a high percentage of vegetable origin macronutrients to integrate the diet. In order to verify the potential of different supplies access available for early hominins outside their African niche, consideration about seasonality differences of food availability had been taken into account.

The results brought us to present a possible reconstruction of the way hominins were exploiting their environment, in which vegetable supply were probably still playing a considerable role compared to meat consumption.

Multi-Spectral Analysis of Landscape Patterns in the Vorotan River Basin

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In this study we combined multispectral remote sensing data with topographic information to assess surface characteristics and related processes in the Vorotan basin. The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) was launched on NASA's TERRA spacecraft in December 1999. It's subsystems cover 3 bands in the visible-near infrared (VNIR), six bands in the shortwave infrared (SWIR) and five bands in the thermal infrared (TIR) wavelength regions. The ground resolution is 15 m, 30 m and 90 m respectively. Two ASTER L1B scenes were purchased for the 29th July 2003 (10:27 UTC). Because the SWIR bands of the L1B data is not corrected for a cross-detector leakage, crosstalk correction was applied using the correction software product from Earth Remote Sensing Data Applications Centre (ERSDAC). The images were also corrected for atmospherical influences.

The topographic characteristics and features were extracted from a Shuttle Radar Topographic Mission (SRTM) X-Band digital elevation model (DEM) with 30 m resolution. The DEM was preprocessed with low pass filtering to extract artefacts and errors like local noise and terraces using SAGA GIS. Subsequently, the DEM was hydrologically corrected eliminating sinks. Digital terrain analysis is a process to describe the terrain quantitatively, from DEM that is grouped in morphometric parameter for describing i) the morphology of the surface, ii) hydrological parameters to describe runoff generation and potential flow pattern as well as transport and deposition of sediments and iii) climatic parameters (Hengl et al., 2003). We performed a detailed Terrain Analysis on the DEM using SAGA 2.0.3.

The study revealed areas that are characterized by homogeneous substrates and specific topographic settings. This classification allows for a better understanding of Palaeo-landscape features and potential archaeological sites.

On the Paleofauna of Acrididae (Orthoptera) and Curculionidae (Coleoptera) of the Diatomaceous Sediments of Southern Armenia (Early Pleistocene, Sisian Suite)

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In diatomaceous sediments of the Sisian Suite, the imprints and remains of more than 1182 insects include species of Coleoptera, Orthoptera, Heteroptera, Trichoptera and Hymenoptera. Quantitatively dominant and securely identified are the genera *Larinus*, *Lixus* (Coleoptera, Curculionidae) and the family Acrididae (Orthoptera).

Beetles of Curculionidae and the Acrididae, which are found almost everywhere in the Sisian Suite, play an important role in ecosystems. They are confined to plant communities of open areas and forest-steppe, and occur today in the southern regions of the Palearctic ecozone. Current data on fossil insects from the Palearctic regions indicate the occurrence of beetles of Curculionids and Acrididae in layers of different geological periods. In particular these include species of the genera *Larinus, Lixus* subfamily Lixinae and family Acrididae (Orthoptera). In the material studied, Curculionid beetles are represented by species of the genera *Larinus* and *Lixus*. There are also isolated finds of the genera *Hylobius* and *Ceuthorhynchus*, which are forest and forest-steppe species, respectively. The Orthoptera are mainly represented by species of the Acrididae family.

The studied Early Pleistocene species of *Larinus, Lixus* and Acrididae belong to the modern phytophagous (herbivorous) fauna widespread in Armenia and are confined to xerophytic vegetation of steppes, deserts and semi-deserts. The studied species of Acrididae choose cereal plants or, in their absence, turn to predation. Species of the genera *Larinus* and *Lixus* in Southern Armenia are mainly inhabitants of xerophytic plant communities, mountain steppe and semi-deserts. These genera also occupy Chenopodiaceae, Apiaceae, sagebrush and grasses in riparian forests. The modern distribution of *Larinus* and *Lixus* points to the occupation of arid mountainous (1800-3000 m) and lowland (800 m) areas and predicts them to the east, which is confirmed by the rich species composition of these genera in the eastern, southern Palearctic. This testifies to their thermophylous and xerophylous character. The same can be said about the Acrididae of genera *Logusta, Calliptamus, Heteracris* and *Metromerus.* The faunal character of the diatomaceous sediments of the Sisian Suite points to the establishment of a warm and dry climate during the Early Pleistocene based on the environmental requirements of the insect species studied.

Magnetostratigraphic Constraints in the Dating of the Dmanisi Sites (Caucasus)

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The site of Dmanisi (Georgia) is a key locality to understand early *Homo* occupations. Dmanisi is located within a volcano-sedimentary succession found along the Masavera River Valley. This succession is comprised of two major stratigraphic units: Stratum A deposits result from a series of ash falls that exhibit weak pedogenic features and minor erosional contacts. Stratum B deposits include primary ashes as well as colluvium. At the A to B transition, a complex of gullies and pipes formed, resulting in the rapid burial and excellent preservation of numerous fossils of *Homo*. Stratified lithic assemblages have been recovered from Stratum A, and lithic artifacts and abundant vertebrate bones come from Stratum B. This volcano-sedimentary succession is found on top of the Masavera lava flow and is overlain by the Kvemo Orozmani lava flow. These volcano-sedimentary and lava flow units can be fully recognized at Zemo Orozmani, Kvemo Orozmani and Dalari, and can be correlated to the Dmanisi sites.

A correct age determination of the Dmanisi succession requires an accurate location of any sample within a detailed lithostratigraphic scheme. This is relevant since depositional and post-depositional processes make it difficult to recognize stratigraphy easily. The age of the Dmanisi sites is based on magnetostratigraphy, biostratigraphy and the absolute age determination (Ar/Ar) from the two lava flows. The latter gives an age of 1.85 Ma for the top of the Masavera basalt and ca. 1.76 Ma for the Zemo Orozmani flow.

Several magneto-stratigraphic studies have been carried out at Dmanisi. The observed results in all units are rather stable and allow us to accurately obtain measurements of the Earth's paleofield. Most recent magneto-stratigraphic studies clearly revealed that Stratum A is built up entirely of normal polarities and correlates with the latest Olduvai Subchron. Conversely, Stratum B contains reverse polarities and is thus correlated with the earliest Matuyama Chron. Stratum A is thus dated between 1.85-1.78 Ma and stratum B is dated between 1.78 and ca. 1.76 Ma. Recent magnetostratigraphic studies at M6 display reverse polarities along the entire section, where several B subunits are found. This scheme confirms the previous paleomagnetic and lithostratigraphic data from other studied areas such as Blocks 2 and M5.

The History of Western Georgia's Vegetation During the Pleistocene

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Western Georgia is an isolated botanical province, the so-called Colchis refuge, where elements of Tertiary floras are still preserved today. The history of the Colchis refuge began at the end of the Middle Sarmatian, which was a turning-point in the geological history of the Caucasus.

After the Sarmatian many subtropical taxa went extinct in the region of western Georgia. In spite of this, subtropical communities continued to exist in the lower mountain belt during the Meotian, Pontian and Kimmerian. Changes in climatic conditions took place in the later part of the Upper Kimmerian and continued through the Lower Kuyalnician. During this time humidity increased, probably connected with the peneplanation of the Greater and Lesser Caucasus. This erosional event modified the unique climate of Colchis, resulting in a mass extinction of thermophilic plants. Subtropical formations disappeared as a separate unit in the region of western Georgia. During the Middle Kuyalnician humidity increased and the temperature regime became more unstable. This is reflected in successive changes from periods dominated by dark conifers to periods characterized by polydominant communities. The vegetation of the Upper Kuyalnician was quite different, as the extent of broad-leaved plants shrank and dark conifers occupied all elevations of the mountains. Thus, the Kuyalnician differed significantly from previous epochs of the Pliocene, both in the absence of evergreen communities and in the frequency and amplitude of climatic fluctuations. After the Kuyalnician the dynamics of the Colchis climate changed and became associated mainly with fluctuations of temperature. Humidity remained high throughout the entire Pleistocene.

Based on its systematical composition, the Gurian flora was the same as the Kuyalnician. The main difference between these two epochs was in the character of vegetation, in that the role of mesophytes increased. In addition, vegetational fluctuations were less pronounced during the Gurian. The end of the Gurian represents the turning point in the history of western Georgia's vegetation. The character of flora significantly changed, in that temperate plants began to predominate. Radical changes also took place in the structure of the vegetation. Polydominant forest, which prevailed during the Kuyalnician and Lower Gurian, split into several communities. Dark conifers occupied the upper mountain belt. In the middle belt, beech began to form a separate monodominant formation, while mixed warm temperate forest was distributed across the lower mountain belt and plains. Such a vegetational structure is still preserved in the region of western Georgia today.

After the Gurian the evolution of flora in western Georgia was associated with the gradual extinction of Pliocene relicts, a process that continued through the Pleistocene. As for vegetation dynamics, under the influences of climatic fluctuations migration of vegetational zones occurred. Cold stages are linked to the Mindel and Würm glacials, while the warm stages are associated with the Mindel-Riss and Riss-Würm interglacials. However, paleobotanical evidence for the Riss glaciation in western Georgia has not yet been observed.

A Taphonomic View of Site Formation and Interactions Between Early *Homo* and the Mammals from Dmanisi

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The mammalian fauna from Dmanisi preserves important clues regarding hypotheses for Out-of-Africa, how the site itself formed, and how hominins behaved. Nearly 10,000 bones were examined for taphonomic information, including taxon assignation, size class, skeletal element and portion preserved, maximum dimension, weathering, surface modifications, breakage patterns, ages of death using tooth eruption and wear, as well as spatial information. This paper concentrates on the fauna from Blocks 1 and 2, especially in Block 1 layer B1, where most of the hominin specimens derive.

Geological and biological processes contributed to the formation, preservation, and alteration of the site. While there was some downhill movement and slumpage of bones by gravity into the gullies and pipes, downhill movement only explains the last moments of bone deposition; it is not enough to explain such a large and diverse concentration of bones at this spot. Biological-behavioral concentrating mechanisms were also at work. The biological processes evident include natural deaths, carnivore hunting, feeding and denning, and hominin feeding.

Carnivores were the largest bone concentrating mechanism; this is especially so in Block 2 B1 sediments. Toothed marked and carnivore broken bones amount to 21.4% of the B1 non-tooth specimens, and the pattern of destruction of skeletal elements is like that commonly seen with carnivore consumption, but not as intense as in many hyena dens. Carnivores themselves are numerous, but interestingly the rarest of the carnivore bones are those of hyena (17 specimens in Block 2 B1 sediments). The pipes would have afforded opportunity for denning. Likewise, gullying in the ashfalls would have provided the topographic change that would have made digging dens easier, as being useful for ambush. 95 carnivore coprolites from Block 2 B1 sediments attest to carnivores living directly on the site. These include coprolites of hyenas as well as other carnivore species. Tooth pit sizes at Dmanisi average close to the means of those made by modern African lions and spotted hyenas. The larger tooth pits were likely be made by *Pachycrocuta* and *Panthera*, and possibly also the saber-toothed cats. Tooth pits also range to the size of smaller carnivores like *Canis*.
Hominins also ate meat at the site, but evidence of this is much rarer than for carnivore modification of bone. Stone tool cut marks have been found on 1% of the specimens. The evidence for human alteration of the fauna through cut marks, hammer stone marks and notches supports an interpretation that hominins had early access to carcasses (likely through hunting, but possibly power scavenging), but also ate marrow and possibly skinned animals. Hominin-carnivore interaction at the site is indicated by spatial overlap of tool and tooth modified bones across the site, cut marks on *Canis* bones, and possible gnawing on hominin bones.

The taphonomic signal from the hominins themselves is generally in keeping with the rest of the fauna from the site. The NISP for *Homo* is 65 (non-tooth NISP=50), with an MNI=5. All of the hominin bones are in Weathering Stages 0 or 1, and 54% of the non-tooth hominin NISP are whole or nearly whole. From a taphonomic perspective, their mortality profile is attritional, but of course the sample is very small. Irregular crenulated breaks on some of the hominin specimens is suggestive of carnivore gnawing, but preservation of delicate elements from early within the carcass consumption sequence suggests carnivore modification of the hominins was very light.

As of the summer of 2012, taphonomic data on some 6389 of 8056 cataloged specimens (80%) and another 3400 examined from screen and unmapped collection bones (mostly small fragments) were recorded. The majority of this analysis is from the catalogued specimens.

Homo erectus Dispersal Patterns for the Out-of-Africa 1 Model and Dmanisi Archaeological Site

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Most scholars agree that the dispersal of humans out of Africa was spurred by both intrinsic population factors and climatic/environmental conditioning. Humans were certainly influenced by the environment they lived in, yet they had to overcome important factors of environmental change. We aim to understand the environmental background of the first *Homo* dispersals out of Africa into Eurasia, the so called Out-of-Africa 1 event. It is essential to assess whether this dynamic background was the result of a major migration event affecting several species at once or unique to *Homo erectus*, and which route did these ancestor of ours take. Before discoveries in Georgia and China, most of the early evidence appeared to support a relatively late initial migration after around 1 Ma, suggesting that for *H. erectus*, the development of Acheulean technology was one of the decisive aspects of dispersal. Today a wealth of available data suggests that the first dispersal happened around 1.9 Ma. If this evidence is correct, such an early dispersal may be better envisioned as driven more strongly by biological and ecological factors than by technological breakthroughs. Around 2 Ma, when *Homo* first arose, the relationship between humans and carnivores began to change. Humans changed their strategy to gain meat, from occasional scavenging towards full predator activity. This process started in East Africa about 1.9 Ma, passed through strong environmental changes and faunal turnovers, and intermingled with major migrations of Paleartic fauna.

In opposition to the so-called "Splitter model" we are attracted to the "Lumper model", focusing on morphological continuity instead of discontinuity. We see the hominin fossil record and mainly representatives of the genus *Homo* lumped into more inclusive species together with their regional and temporal variation. Today there is general agreement that *H. erectus* evolved in Africa, and then spread across Eurasia. According to fossil remains it is evident that *H. erectus* was fully bipedal, with mosaic morphology of archaic and modern traits in his hind limbs suggesting the development of decreasing energy costs of locomotion. Consequently, this species was able to migrate over long distances.

Based on this information we performed a macro-ecological analysis for *H. erectus* together with contemporaneous large mammals via the computation of a "preferred" route during the dispersal through Eurasia. The database was assembled via inspection of the relevant literature, assessing and entering information from Web-based repositories. Sources included the Paleobiology Database (paleodb), New and Old Worlds (NOW) database of fossil mammals, and PANGAEA database. We entered all *H. erectus* records into our database, including both faunal lists and cultural attribution to see interaction between these two fields. The database comprises some localities with different geographic coordinates, but the same estimated ages, thus preventing a unique hypothesis of *H. erectus* dispersal. To overcome this problem we computed all the possible combinations of localities with the same age to produce different dispersal path hypotheses. Then we assessed the localities' ordination with the minimum cumulative geographic distance, provided this ordination was computed as the least-cost route from Africa towards Eurasia.

A least-cost path is the minimum cost track that a species can walk to minimize its energy consumption, by specifying a particular function for energy preservation. For *H. erectus* we computed the least-cost path assuming that this species would have avoided very high altitudes to disperse through Eurasia from Africa. To this aim we used a Plio-Pleistocene topographic map of Africa and Eurasia (PRISM 3D Project) and values of altitudes as a variable of the function of minimum energy consumption. Additionally, we added large Pleistocene mammals to the picture to model the migrations of the species which dispersed together with humans, and how they were affected by humans or *vice versa*.

The least-cost routes for the *H. erectus* dispersal show that the easiest way to get out of Africa was via Egypt along the so-called "Sinai bridge". The uplift of the Himalayan plateau as a barrier skewed the direction of dispersal towards Southeast and East Asia. The distribution of Early Pleistocene archaeological sites we chose is well documented and in accordance with the so-called "Movius Line" of the Eurasian archaeological record. This division can be explained on the basis of the argument that *Homo* arrived in East Asia prior to the development of Acheulean technology, but such a hypothesis does not demonstrate why the Acheulean tradition did not subsequently spread into Southeast and East Asia. As such, our route estimates are open to several views of diffusion of *H. erectus* across Southeast Asia.

For this research model, the Southern Caucasus and especially the archaeological site of Dmanisi (Georgia) play an important role as the oldest evidence of the genus *Homo* out of Africa. Together with its Oldowan stone industry and late Villafranchian fauna, it is possible to draw connecting routes joining Africa with Eurasia and the faunal exchange between them. The question of an early dispersal of the genus *Homo* out of Africa into Eurasia has usually been considered in terms of chronological context, or in terms of cultural expansion. It has never been seriously considered that humans are an integral part of ecosystems and that human dispersals are only one aspect of a wider, dynamically changing, natural system in a scenario where geography, climate and environmental factors pattern the evolution of ecosystems in time.

The Hominids of Dmanisi and Their Environment

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The unusual finds of ancient hominids of Dmanisi have been reported frequently in scientific publications. Nevertheless, it is useful to recall briefly the composition of the fauna and its importance to understand the environment. In preliminary notes concerning the remains of ancient hominids of Dmanisi, we distinguished two populations: *Homo georgicus* and *H.* ex gr. *ergaster*, pointing out the need to clarify the position of *H.* Dahl ex gr. *ergaster* in the system of ancient hominids (Gabunia et al. 2000, 2001).

In this paper, we focus attention on the vertebrate fauna accompanying *Homo* from Dmanisi which serves as a convincing testament to the antiquity of bone-bearing sediments and the specifics of the environment. At present, the Dmanisi faunistic complex includes: *Bufo viridis*, *Testudo graeca*, *Lacerta* aff. *strigata*, *Struthio dmanisensis*, *Phasianus dmanisensis*, *Strix gigas*, *Ochotona lagreli*, *Hypolagus* of. *brachygnathus*, *Marmota* sp. , *Mimomys tornensis*, *M. reidi*, *Apodemus dominans*, *Hystrix refosa*, *Lynz issiodorensis*, *Panthera onca georgica*, *P. Gamboszoegensis*, *Acinonyx pardinensis*, *Megantereon cultridens*, *Homotherium crenantidens*, *Pachycrocuta perrieri*, *Canis etruscus*, *Ursus etruscus*, *Cervus perrieri*, *Eocladoceros senezensis*, *Arvernoceros insolitus*, *Palaeotragus rouenii*, *Dmanisibos georgicus*, *Gazella borbonica*, *Capra dalii*, *Equus stenonis*, *Equus latidens*, *Dicerorhinus etruscus etruscus*, and *Mammuthus meridionalis taribanensis* (abbreviated list). Of special attention is the presence of the giant ostrich in the fauna of Dmanisi whose favorite habitat is savannah-type open spaces.

The fauna of Dmanisi vertebrates reflects a fairly wide variety of landscape conditions consistent with the results of palynological studies. The highest concentration of pollen is observed in the lower layers of bone-bearing sediment. In the floristic spectra, arboreal species such as pine, fir, hornbeam, alder, maple and birch predominate. The presence of hemlock and hazelnut pollen is noted. In coprolites, pollen grains of fir, chestnut, elm and willow were found. The dominant herbaceous species are Asteraceae, Umbelliferae and Chenopodiaceae, and among spore-bearing plants, ferns predominate (Kvavadze and Vekua 1993). In almost all layers, *Celtis glabrata* fruits and seeds were found.
It is quite evident that in the Upper Villafranchian of the Southern Caucasus, in particular in the region of eastern Georgia, forested areas probably occupied mountain ravines, gorges and river watersheds. However, the presence of Poaceae and Chenopodiaceae along with the abundance of Boraginaceae fruits in the palynological spectra indicates the wide development of the open savannah-type landscape. This conclusion is supported by the presence of bone remains of giant ostrich, groundhog, gerbils, horses, *Paleotragus*, Southern elephant and Etruscan rhinoceros, for example.

On the whole, the data from vertebrate paleontology and palynology show the predominance of rather warm and moderately humid climatic conditions in the region of the Southern Caucasus during the Late Neogene, which apparently was not contrary to the development of relatively dry habitats in the foothills.

References:

Gabunia L., A. Vekua A., Lordkipanidze D. 2000. New Human fossils from Dmanisi East Georgia. Archeology, Ethnology, Anthropology of Eurasia, 2 (6):128-139.
Gabunia L., A. Vekua A., Lordkipanidze D. 2001. Rare palynological discoveries in Dmanisi. Dmanisi III, Metsniereba, Tbilisi, pp.9-41.
Kvavadze E, Vekua A. 1993. Vegetation and Climate of the Dmanisi man Period (East Georgia) from Palynological data. Acta Paleobotanica, Cracov, 33(2): 343-355.

New Data on Late Pleistocene Geographic Variation Among Faunal Communities of the Southern Caucasus

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Archaeological research in the Southern Caucasus during the last decade has contributed a tremendous amount of new data on faunal assemblages from the Late Pleistocene. Unlike most previous research from the 20th century these recent data are backed by precise chronometric studies and anchored to detailed chronostratigraphies. We use both macro- and micro-mammalian assemblages from cave sites in different geographic locations and altitudes (Georgia: Dzudzuana, Ortvale Klde, Kotias Klde, Satsurbliya; Armenia: Hovk-1, Lusakert, Aghitu-3, Areni) to examine ecosystem dynamics of the last 100 ka. With these data we attempt to address such issues as faunal dynamics versus stability through time and the extent of paleogeographic faunal variation across the region and in comparison to the present. This study represents the first integrated, high-resolution analysis of the mammalian record of the region in the Late Pleistocene. Based on this preliminary effort we assess for the first time the biological functioning of the Caucasus during a critical period in human expansion across Eurasia and test competing hypotheses such as the functioning of the Caucasus as a migration corridor versus a barrier to expansions.

ABSTRACTS

of

POSTER

Contributions

in alphabetical order

The Basement Rocks Beneath the Sisian Formation (Southern Armenia)

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A vast amount of data was recovered during former exploration and mapping of the diatomaceous formations of the Vorotan River Basin. These data have been used along with data from new explorations to ensure the correctness of this work. In all, 47 boreholes, ten geological sections and 12 geological maps were digitized. Using this information, we reconstructed the roof and the floor of the diatomaceous depsoits in a three-dimensional view in order to delineate the paleolakes. On the basis of digitization of the geological information on a scale ranging from 1:25,000-200,000, we present a geological map at a scale of 1:25,000.

The Vorotan River Basin compromises an area of ca. 2000 km^2 and is represented by the following geological formations:

1. Paleozoic: Metamorphosed hornblende and diabasic porphyries spread over the northern branches of the Bargoushat Range are broken through by intrusions in many places.
2. Lower Cretaceous: Conglomerates, sandstones, marlstones, argillites and tuff breccias of the Vorotan horizon, 250-300 m thick.
3. Middle Eocene: Tuff sandstones and tuffs, 300 m thick, are intruded by granodiorites and outcrop near the village of Aravous.
4. Upper Eocene: Volcanogenic rocks of the Amoulsar horizon are represented by diverse andesites, as well as their tuffs and tuff breccias, and outcrop near the mountains of Amoulsar and Salvard .
5. Oligocene is divided into two horizons:
    a. Conglomerates, tuff conglomerates, tuff breccias, tuff sandstones and sandstones.
    b. Andesites, tuffs and tuff breccias outcrop near Brnakot, Shaki ,Sisian, and are intruded by granodiorite.
6. Miocene: The tuffs and tuff breccias of this age outcrop between Hatsavan and Brnakot villages in the river basins of Salvard, Sisian and Lernashen.
7. Lower Pleistocene is divided into three formations.

Lacustrine diatomaceous deposits outcrop intermittently along both banks of the Vorotan River from northwest to southeast from the villages of Gorayk to Ltsen and are joined by four intermontane basins: Hankadasht, Angheghakot, Sisian and Shamb. The width of this band of lacustrine diatomaceous rock fluctuates from 3.5 km in Hankadasht Basin to 17.5 km in the Sisian Basin. Based on its petrographic composition and conditions of bedding, the deposit is divided into two horizons: i) lower*,* represented by shingles, sandstones and pumiceous ashy materials; and ii) upper, represented by clayey diatomites and diatomaceous clays interlaced with beds of ashy and pumiceous pyroclastic material, as well as lacustrine fluvial terrigenous formations.

Based on observations near the village of Shamb, we determined the occurrence of 45 facies within the upper horizon, of which 22 beds are composed of clayey diatomites. In the region six varieties of diatomites are documented: 1) diatomites, 2) clayey diatomites, 3) diatomaceous clays, 4) sandy diatomites (among which the sandy loam and loamy varieties can be identified), 5) ashy diatomites, and 6) diatomaceous breccias. In one case the diatomites of the Sisian Basin are underlain by the weathered granodiorites and tuff breccias of Eocene age. In another case, they are underlain by the volcanic sands and boulder shingle deposits representing the early stage of formation of a paleolake and ancient paleochannels of rivers. The thickness of the diatomaceous lacustrine deposits ranges from just a few meters in the northwest, to about 300-350 m in the southeast, with the thickness averaging from ca. 70-100 m.

The volcanogenic detrital rocks of the Goris deposits are represented by tuff breccias and tuff conglomerates. In the middle course of the Vorotan River Basin, near the villages of Shamb, Vorotan and Vaghatin, facies of diatomaceous deposits transition into the volcanogenic sedimentary of the Goris deposits. This transition is expressed in multiple interstratifications of the rocks of those deposits.

The Vorotan depression represents an inclined synclinal trough filled with lacustrine diatomaceous deposits and lava sheets. The Vorotan depression is separated from the Middle Arpa depression to the northwest by the anticlinal upheaval of the Vorotan pass. To the southeast it is closed by the cross bulkhead of the Tatev-Goris tectonic upheaval which separates the Vorotan depression from the Akera depression.

Quaternary Fluvio-Lacustrine Sediments and Fossil Vertebrate Sites of the Akhalkalaki Plateau (Southern Georgia)

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Georgia, as the part of the Caucasus, is located between the still converging Eurasian and African-Arabian lithospheric plates and belongs to the Alpine-Himalayan fold-thrust mountain belt. The Javakheti volcanic plateau is attributed to the Artvin-Bolnisi block according to the tectonic setting of Georgia (Adamia et al., 2004).The Javakheti plateau is composed of Neogene-Quaternary post-collisional volcanic formations (Adamia et al., 2008) where three stages of volcanism are distinguished: 1) Late Miocene andesite-dacitic – Goderdzi Suite; 2) Upper Pliocene-Pleistocene basaltic – Akhalkalaki Suite; and 3) Holocene rhyolitic and dacitic – Abul-Samsari Formation.

Our goal was to map the fluvio-lacustrine sediments of the Akhalkalaki plateau. The Akhalkalaki volcanic plateau is built up by the alternation of subaerial basaltic and andesitic lava flows and fluvio-lacustrine deposits (Akhalkalaki suite). Two levels of lava flow facies can be identified here, each comprising several flow units. At the same time, lava flow facies alternate with the lower and upper fluvio-lacustrine sedimentary deposits.

The lower fluvio-lacustrine sediments are sandwiched between two basalt flows which are dated by means of magnetostratigraphy and radiometric methods. The age of the lower flow is 3.75-2.9 Ma and of the upper flow, 2.5-1.55 Ma (Lebedev et al., 2007), Swischer (Ferring et al., 1996). The lower lacustrine sediments outcrop in the village of Diliska on the left bank of the Korkhistskali River and in the town of Akhalkalaki. Mammalian fauna, known in the literature as the Diliska fauna, was found in the sediments dated to 2 Ma (Djigauri, 1991; Vekua et al., 2009).

The upper fluvio-lacustrine sediments are exposed in two outcrops: in the village of Diliska and in the town of Akhalkalaki on the western slope of Amiranisgora Mountain. In the colluvium on top of the fluvial sediments the Akhalkalaki fauna was found. Excavations at Amiranisgora Mountain in the 1950s and 1990s uncovered thousands of bones of an early Galerian fauna (Akhalkalaki fauna), including the remains of a new species, *Equushipparionoides* (Vekua, 1962, 1987). Based on magnetostratigraphy this site corresponds to the time span between 0.98-0.78 Ma (Tappen at al., 2001).

In the villages of Baraleti, Zakvi and Khospio and on gorge of the Kirkhbulakh River, four new outcrops of upper fluvio-lacustrine sediments were identified and investigated as a result of recent observations within the study area. Additionally, one outcrop of lower fluvio-lacustrine sediments was located on gorge of the Kirkhbulakh River. The distribution of boundaries of paleolakes were outlined accordingly. Based on lithofacies analyses of the deposits mentioned and stratigraphic correlations, we propose that two chronologically successive lakes existed within the Akhalkalaki plateau, one during the Late Pliocene and Early Pleistocene and another at the end of the Early Pleistocene. These lakes apparently originated due to the damming of the Paravani River by lavas.

References:

Adamia Sh., V. Alania, A. Chabukiani A., Kuloshvili S., Maisuradze G., & Gotsiridze G. (2004). Seismic source zone models of recent earthquakes of Georgia. Proceedings of 5th International Symposium on Eastern Geology. Vol. II.pp.545-448.

Adamia, Sh., Mumladze, T., Sadradze, N., Tsereteli, E., Tsereteli, N. & Varazanashvili, O. (2008). Late Cenozoic tectonics and geodynamics of Georgia (SW Caucasus). Georgian International Journal of Science and Technology, 1,77–107. ISSN pp. 1939-5825.

Djigauri, D. (1991). The South Georgian highland. In: Kiknadze, T. (ed.) Georgia in Anthropogene. Tbilisi, Sakartvelo, pp.91–128.

Ferring C., Swisher C., Bosinsky G., Gabunia L., Kikodze Z., Lordkipanidze D., Tvalchrelidze M., Tutberidze B. (1996). Progress report on the geology of the Plio-Pleistocene Dmainisi and The Diliska george. Republic of Georgia. Paleoant. Soc., New Orlean, pp. 5-6.

Lebedev V. A., Bubnov C. N., Dudauri O. Z., Vashakidze G. T. (2007). Geochronology of Pliocene volcanism of the Javakheti highland (the Lesser Caucasus). Paper 1. Western part of the Dzhavakheti Highland. Regional geological correlation. Stratigraphy and Geological Correlation vol.16 N2, pp. 105-127.

Tappen M., Adler D.S., Ferring R., Gabunia L., Vekua A., Swisher III, C.C. (2001). Akhalkalaki: The taphonomy of An Early Pleictocene Locality in Republic of Georgia. J. of Archaeol. Sci. 29, pp. 1367-1391.

Vekua, A. (1962). The Lower Pleistocene Fauna of Mammals of Akhalkalaki, Tbilisi, pp.1-207.

Vekua, A. (1987). The Lower Pleistocene mammalian fauna of Akhalkalaki (Southern Georgia, USSR). Palaeontographia Italica 74, pp. 63–96.

Vekua, A., Lordkipanidze D., Bukhsianidze M., Vanishvili N., Chagelishvili R. (2009). Importance of Diliska Vertebrate Fauna for the Biostratigraphy of South Caucasus. Bulletin of the Georgian National Academy of Sciences. vol. 3. №2. pp. 130-135.

Early Pleistocene Freshwater and Terrestrial Molluscs from Southern Armenia

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In the basin of the middle and upper courses of the Vorotan River, Syunik Region, southern Armenia we have found fossil remains of Early Pleistocene freshwater and terrestrial molluscs (Bivalvia, Gastropoda). Eight families and 12 genera of molluscs are present, and among these remains, we identified 12 species. The eight families are listed below:

Bivalvia:
1. Fam. Pisidiidae – *Musculim sp.*; - *Sphaerium corneum*; - *Pisidium casertanum*; *P. altum*; *P. vincentianum*; *P. subtruncatum*; *P. subterraneum*. *Pisidiidae* – small bivalves. These species inhabit springs, small rivers, riparian and supplementary systems of large rivers, irrigation networks, swamps, pools, ponds, lakes, storage ponds, and can be found in silt and sandy-silty sediment. The most common species among these molluscs is *P. casertanum*. Distributed in all regions and zones, even reaching more than 3000 m in elevation, *P. casertanum* is also found in bodies of water up to a depth of 20 m.

Gastropoda:
2. Fam. Planorbidae – *Anisus spirorbis*. Inhabits shallow water bodies.
3. Fam. Succineidae – *Oxyloma* sp. Distributed worldwide. The majority have an amphibiotic lifestyle on the shore of freshwater bodies, while some inhabit humid habitats on land.
4. Fam. Valloniidae – *Vallonia pulchella*. In Armenia these are distributed in mountainous steppes and forests, sometimes in semi-deserts and lower alpine zones.
5. Fam. Enidae – *Chondrula tridens*. In Armenia they have a wide distribution from deserts to grasslands. They are mostly characteristic of forest margins; *Napaeopsis hohenackeri*. Wide distribution in Armenia in the mountainous steppes, as well as in phrygana scrubland vegetation and in the lower alpine zone, mainly on southern slopes.
6. Fam. Vertiginidae – *Vertigo sp*. *Columella columella*. Mesophilous and hygrophilous habitats.
7. Fam. Zonitidae – *Oxychilus sieversi*. Rock cracks, screes, alluvial sand.
8. Fam. Clausiliidae – *Euxina* sp. Inhabits the upper parts of forests, grasslands and subalpine open woodlands.

The presence of freshwater molluscs, whose recent relatives are found in lakes up to 20 m in depth, allows us to conclude that during the Early Pleistocene lakes and flowing water bodies were present in the region of Armenia. The presence of terrestrial molluscs confirms the presence of subalpine open woodland, forest and mountainous steppes with temperate climate.

Palynomorphological Investigation of the Genus *Quercus* L.

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The main purpose of this work is the palynomorphological investigation of the modern species of the genus *Quercus* native to Armenia and adjacent regions including the Caucasus and Transcaucasia, the Mediterranean region (especially Turkey), as well as Iran, Iraq and Afghanistan. The study of the pollen morphology of 19 species of the genus *Quercus* was carried out with the help of light (LM) and scanning electron (SEM) microscopes. The vast majority of the studied species belongs to the subgenus *Quercus* (exclusively deciduous trees) while only four species belonged to the subgenus *Heterobalanus* (sclerophyllous evergreen trees and shrubs). The allocation of species within the subgenera, sections and subsections was done mainly in accordance with Menitsky's system.

Pollen material was gathered from herbaria at the Institute of Botany of the National Academy of Sciences (IB-NAS) in Yerevan, the Senckenberg Research Institute and Natural History Museum (SRI-NHM) in Frankfurt, and the State Museum of Natural History in Stuttgart. The study of pollen grains using LM was conducted at IB-NAS and SRI-NHM, while SEM studies occurred at SRI-NHM. The data collected will provide the basis for the clarification of the taxonomy of the genus *Quercus* at the level of subgenera, sections and subsections, as well as for future comparative analysis of modern and fossil pollen of *Quercus* discovered in the basin of the Vorotan River in southern Armenia.

Species examined include: *Quercus aegilops* L., *Q. alnifolia* Poech, *Q. araxina* (Trautv.) Grossh (= *Q. infectoria* ssp. *boissieri* (Reut.) O. Schwarz), *Q. brantii* Lindl., *Q. castaneifolia* C.A.M., *Q. cerris* L., *Q. coccifera* L., *Q. dschorochensis* K. Koch (= *Q. petraea* ssp. *dschorochensis* (K. Koch) Menits.), *Q. faginea* Lam., *Q. frainetto* Ten., *Q. iberica* Stev. (= *Q. petrea* ssp. *iberica*, *= Q. hypochrysa* Stev.), *Q. ilex* L., *Q. macranthera* Fisch. et C.A. Mey. ex Hohen, Q. persica *Jaub. & Spach*, *Q. petraea* L. ex Liebl., *Q. pontica* K. Koch, *Q. pubescens* Willd., *Q. robur* L. (= *Q. pedunculata* Ehrh.) and *Q. suber* L.

Subgenus Quercus

Section Quercus

Subsect. Ponticae

Pollen grains are 3-zonocolp-poroidate (porate), colpi are long, geniculate. Pore areas are weakly expressed, deckle-edged. On the level of LM, exine ornamentation is regularly finely verrucate; on the level of SEM, ornamentation is perforate-microtuberculate (*Q. pontica*).

Subsect. Quercus

Pollen grains are 3-zonocolp-porate with clearly defined pores (*Q. dschorochensis*), 3-zonocolp-poroidate (porate) (*Q. robur*), 3-colpate or colp-poroidate (*Q. petraea*, *Q. iberica*).
Colpi are medium length or long, often geniculate (except *Q. dschorochensis*). Exine ornamentation in all four investigated species is verrucate (LM); on the level of SEM, ornamentation is perforate-granulate-verrucated, verrucae are often approximated; granules are usually disposed between verrucae (*Q. robur*, *Q. petraea*, *Q. iberica*), and also on the verrucae surface (*Q. robur*).

On the level of SEM, exine ornamentation of the pollen of *Q. dschorochensis* is perforate-plicato-microtuberculate, the surface of the individual tubercles is undulate, the fine granules or spines are sometimes revealed between the tubercles.

Subsect. Macrantherae

Polen grains are 3-zonocolpate, 3-zonocolp-poroidate. Colpi long, geniculate (*Q. macranthera*) or without **geniculum** (*Q. frainetto*). On the level of LM, exine ornamentation of the pollen of both species is verrucate; on the level of SEM, ornamentation is perforate-granulate-microverrucate, verrucae are usually gathered into groups, occasionally solitary; both on the surface and between of the verrucae the granules are observed.

Subsect. Gallifera

Polen grains are 3-zonocolpate, 3-zonocolp-poroidate. Colpi medium length or long, geniculate (*Q. araxina*, *Q. pubescens*) or without **geniculum** (*Q. faginea*). On the level of LM, exine ornamentation of all three species is verrucate; on the level of SEM, ornamentation is perforate-granulate-verrucate, verrucae are usually gathered into the groups, occasionally solitary; on the surface of the verrucae the granules are observed (*Q. araxina*).

Section Cerris

Subsect. Cerris

Pollen grains are 3-zonocolp-poroidate (porate), colpi are long, without geniculum. On the level of LM, exine ornamentation are granulate (*Q. castaneifolia*) or microverrucate (*Q. cerris*); on the level of SEM, ornamentation are perforate-verrucate, verrucae are usually gathered into the groups (*Q. castaneifolia*), or perforate-granulate-verrucate, on the surface of the verrucae the granules are observed (*Q. cerris*).

Subsect. Aegilops

Pollen grains are 3-zonocolpate or 3-zonocolp-poroidate (porate). Colpi are long (*Q. aegilops*) or medium length (*Q. brantii*, *Q. persica*), geniculate (*Q. brantii*, *Q. aegilops*) or without geniculum (*Q. persica*). On the level of LM, exine ornamentation is microverrucate, verrucae are usually gathered into the groups; on the level of SEM, ornamentation is perforate-verrucate, verrucae are rounded or conically constricted at the ends (*Q. brantii*, *Q. persica*), solitary or gathered into the small groups; surface of pollen grains is undulate (*Q. brantii*, *Q. aegilops*).

Subgenus Heterobalanus

Section Heterobalanus

Subsect. Heterobalanus

Pollen grains are 3-zonocolp-poroidate (porate). Colpi are long, usually geniculate. On the level of LM, exine ornamentation is verrucate; on the level of SEM, ornamentation are perforate-plicato-microverrucate (spinulate) (*Q. alnifolia*) or perforate-microverrucate, verrucae usually solitary, rounded or conically constricted at the ends (*Q. suber*).

Section Ilex

Subsect. Ilex

Pollen grains are 3-zonocolp-poroidate (porate). Colpi are medium length or long (*Q. ilex*), usually genicilate. On the level of LM, exine ornamentation is microverrucate (*Q. coccifera*) or spinulose (*Q. ilex*); on the level of SEM, ornamentation perforate and sinuously microplicate, plicae often branched, mainly located in different planes and intertwined with each other (*Q. coccifera*) or microplicate-tuberculate, tuberculi often cone-shaped (*Q. ilex*).

Ostracods from the Halidzor Section

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Armenia is located on the border of the Eurasian and Arabian plates. Here, sedimentary rocks from Pleistocene lakes contain abundant mollusks and ostracods, as well as other faunistic and floristic assemblages. The sections studied here are located in the Syunik Highlands of southeastern Armenia, where the Vorotan River Basin is situated in the Vorotan synclinal depression, which began its formation during the Miocene. One of these Upper Pliocene-Quaternary sections is located between the villages of Tatev and Halidzor, on the right side of the Goris-Tatev road, were yellow colored clays, loams, loamy sands with gravel and sands outcrop over nearly 70 m length. The typical lake sediments are horizontally layered.

The upper part of the section is formed by gray sands saturated with pumice and whitish loams (10 m thickness), all gradually replaced by a thick layer of tephra with some intercalations (60-180 m thickness). The whole section is covered by andesite-basalts (5-10 m thickness). The age of this lava flow is radiometrically dated to 1.6±0.5 Ma (Sayadyan 2009).

The lake sediments below the volcanoclastics have a thickness of 36 m and are horizontally layered gravels, sands, loamy sands, and characteristic brown loams with abundant tephra of gravel size and finer dimensions. Based on their lithology, these deposits are similar to the layers of the Sisian Formation, but Sayadyan (2009) called them the Tatev lake beds.

This work is based only on materials from the Halidzor collections from outcrop 2 (nearly 9 m thickness) and outcrop 3 (nearly 7 m thickness). From the Tatev lake beds of the section Halidzor-1, 45 samples were collected during field work in 2012. Altogether eight freshwater ostracod taxa were identified: *Bythocypris* sp., *Candona* sp., *Candoniella* sp., *Cypridopsis* sp., *Darwinula* sp., *Iliocypris* sp., *Limnocythere* sp. and *Zonocypris* sp. These genera appear in shallow water conditions and prefer cold water**.**

References

Sayadyan, Y.V., 2009. The newest geological history of Armenia. Publisher Gitutjun, Armenian Academy of Sciences, Yerevan. 356 pp.

Renewed Excavations at the Middle Pleistocene to Holocene Complex of Azokh Cave, Lesser Caucasus

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Azokh Cave is situated in Nagorno Karabakh, southeastern Lesser Caucasus (39°37.15’ N, 46°59.32’ E, 962 m above sea level), near the village of the same name. The site consists of a series of cave chambers located within a Mesozoic limestone karstic system that contains Pleistocene to Holocene fossiliferous strata. The site was initially discovered in 1960 by M. M. Huseinov, and the main chamber was extensively excavated over the course of the following twenty-years. Several stratigraphic horizons were observed during this time, a number of which contained fossil and archaeological material. Abundant faunal remains were recovered at the site, including both large and small vertebrates, along with a contemporaneous lithic assemblage representing Acheulian and Mousterian technologies. In 1968 a fragment of a hominin mandible was found, and this was thought to represent the transition between *Homo erectus* and *H. neanderthalensis*.

Excavation work at Azokh Cave was resumed by the present international and multidisciplinary research group in 2002 and has continued to the present. This new phase of excavation has revealed a long stratigraphic sequence, spanning more than 300,000 years from the Middle Pleistocene to the Holocene, with evidence of occupation of the cave by three hominin species. Systematic methods for the recovery, recording and processing of finds have been introduced. Lithostratigraphic units for the cave-filling succession have been clearly defined and described, radiometric dating has been conducted, and the topography of the entire cave system has been mapped out. The latter work has revealed four new cave entrances, two of which contain undisturbed strata containing fossiliferous and archaeological material. Here we present results of the renewed excavations at the site, on-going research on the material, and future plans for work at Azokh Cave.

Biodiversity of a Holocene Faunal Assemblage from Lake Sevan (Armenia)

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Remains of animal bones are an essential scientific source to study the history of ancient fauna. In this respect, the material excavated in natural bone deposits belonging to the Holocene in the Lake Sevan Basin of Armenia is of great interest. Lake Sevan, or as they called it in ancient times, Geghama Sea, is one of the world's largest high-altitude lakes. It is situated in an active tectonic basin rimmed by mountain ranges and situated at 1900 m above sea level. The lowest part of the basin is filled with water.

A natural burial place of bones is concentrated on the southwestern coast of Lake Sevan near the Ayrivan monastery. The belt extends along the wave-cut zone all the way up to Cape Noraduz, extending over 500 m in length and about 50-60 m in width. The layers forming these strata relate to paleofluvial deposits of the Early Holocene. These rocks contain remains of animal bones within two strata that alternate with diagonally-layered sand. The faunal composition is rich and includes *Bison* sp., *Bos* sp., *Cervus elaphus*, *Canis lupus*, *Vulpes vulpes*, *Sus* sp. and others. Pathologic changes on Bovidae skulls, and various disease states and injuries on them are of great interest.

Ten species of freshwater mussels were also found in silty-sandy rocks of gray color, with layers of sand cemented on the remains of mammals: 1. *Valvata piscinalis* (Muller, 1774); 2. *Bithynia troscheli* Paasch, 1842; 3. *Lymnaea stagnalis* (Linnaeus, 1758); 4. *L. stagnalis* var. *goktchana* Mousson, 1873; 5. *L. auricularia* Linnaeus, 1758; 6. *L. ovata* (Draparnaud,1805); 7. *Planorbis carinatus* Muller, 1774; 8. *P. planorbis* (Linneaus, 1758); 9. *Gyraulus leavis* (Alder, 1378); 10. *Euglesa casertana* (Polli, 1791). Two of them*, Bithynia troscheli* and *Planorbis carinatus*, are glacial relicts.

Non-Pollen Palynomorphs in the Pleistocene Pollen Spectra of Javakheti Plateau (Southern Georgia)

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Early Pleistocene volcanoclastic, lacustrine and fluvio-lacustrine sediments from different locations of the Javakheti Plateau have been investigated palynologically. These locations are Diliska; Sakvi; Baraleti; Hospic 1, 2; Akhalkalaki fossil site; and Akhalkalaki Kirchbulake 1, 2.

The laboratory treatment of the material was carried out by two methods. In Georgia, in the laboratory of the Institute of Paleobiology, the Grichuk and Zaklinskaya method was used. It involves boiling in 10% KOH or NaOH, followed by isolation of pollen by centrifuging in cadmium liquid (Cdl-2). In the final stage, acetolysis was performed. In the palynological laboratory of Senckenberg Research Institute the material was treated in hydrofluoric acid (HF), but no acetolysis was performed. This experiment showed that when treating sediments in hydrofluoric acid, many non-pollen palynomorphs (NPPs), such as phytoliths, diatoms and leaves, are destroyed.

The investigation showed that, on the whole, the material from the Javakheti Plateau does not contain large quantities of pollen and spores in Early Pleistocene sediments. In diatoms and ferruginous red clays there is no pollen at all. However, similar to volcanogenic formations, they are rather rich in various NPPs. This group of palynomorphs includes the remains of various freshwater algae, cyanobacteria, phytoliths, fungi spores, tracheal cells of wood, animal hairs, remains of insects and invertebrates. These NPPs provide valuable information on paleogeographic conditions of the region at the time when they accumulated.

Of great interest are the palynological spectra of the Baraleti profile located at an altitude of 1699 m. In white clays dated between 0.98-0.78 Ma, together with the remains of freshwater algae, a large quantity of tracheal cells of wood was found, indicating that at that time there was a lakeside whose slopes were covered with forest vegetation. Among the arboreal pollen, pine predominates. On the whole, the amount of pollen of arboreal species is three times higher than that of the herbaceous plants. Besides pine, the spectrum contains the pollen of cedar, spruce, birch, beech, oak and alder. Among herbaceous species, grasses that probably grew on the shore of the lake predominate. The existence of forest vegetation in the given time interval from 0.98-0.78 Ma is also confirmed by the spectra of the clays from the profiles of the Akhalakalaki fossil site and Akhalakalaki Kirchbulake-1 at an altitude of 1706 m. In addition to pollen of arboreal species and cells of their wood, spores of the fungus *Ustulina*, which grows only on the trunks of trees, were found here.

A Sculptural Image of Paleolithic Women from Okumi Cave

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Among the Paleolithic cave dwellings of Western Georgia, Okumi is one of the sites that holds an important place in the study of the origin and development of Georgian Upper Paleolithic cultures. The cave is karstic, lying near the valley of Ghumurishi in the Gali district, formed in the Lower Calcareous limestone of the Okumi River canyon. The cave is on the left bank of the river, 300 m above sea level, and 11 m above the level of the river.

Excavations from 1968-1972 showed that the cave is a Late Pleistocene multilayered site with Upper Paleolithic cultural horizons. Of the eight lithological layers, the fourth to the eighth are Upper Paleolithic with a total thickness of 1.5 m. The stone industry identified in the cave comprises thousands of flint tools with traces of manufacture. Quaternary period animals have also been identified, pointing to a long period of human habitation here.

While examining the material from the cave, our attention was drawn to two small specimens of Paleolithic art, sculptural representations of man. This fact is of major significance in the study of Georgian Upper Paleolithic art. The sculptures have labels attached with inscriptions in Georgian and Russian telling of their discovery during excavation in layer 5, square H8 of Okumi Cave on Aug. 16, 1972. Metatarsal bones of the ibex (*Capra caucasica*) were used to make these human sculptures

Statuette 1 has a round head and elongated body; the arms are not carved out; the legs are cut off obliquely. The length of the statuette is 5 cm, with an average width of 2 cm and a thickness of 1 cm. The head is separated from the body by a slight narrowing. The face is smooth, features are not carved out; in the centre of the face there is a natural hollow. The chest is weakly separated and not pronounced. The same is true of the belly: the back is flat; it is weakly modeled by whittling; the shoulders are rounded and stooping.

The distal part of the left foot of *C. caucasica* was also used for statuette 2. It is split along the longitudinal axis. The directing sharp ridge of the joint trochlea has survived. The fairly deep and wide joint hollow is on the lateral side of the bone. The specimen bears clear signs of artificial treatment. As noted above, it must have been an unfinished schematic image of a human being. It is 5.5 cm in length, 2 cm wide and 1.5 cm thick. The figure is executed by exactly the same technique as the first statuette, but the linear trace and polish of the latter are very faint. A large part of the specimen is covered with calcitic deposit.

Realistically depicted sculptural images of human beings hold an important place in Paleolithic art. They have been found in Spain, France, Britain, Belgium, Germany, Italy, Austria, Czech Republic, Russia and the Ukraine (in the basins of the Dniester, Desna, Seim, Don, Angara, and other rivers). As shown by discoveries in the entire glacial zone of Europe, beginning with the Aurignacian-Perigordian period to the Solutrean-Magdalenian period, realistically depicted images of women become widespread in the shape of small figurines. Along with these, stylized and schematic images of woman have also been discovered. Statuettes with generalized outline are also identified, which doubtlessly depict women. The most characteristic features–chest, belly, thighs–are not pronounced, but represented in general relief. The Okumi cave statuettes must belong to the latter group.

Similar statuettes have not been found either in Georgia or the Caucasus. Nor can precise analogues be found among statuettes of Western Europe or Siberia. In comparison with the rich specimens of Upper Paleolithic art from Europe and Siberia, Georgian and generally, Caucasian Upper Paleolithic art, looks much more modest. The Okumi statuettes remind us rather of the sketchy female statuettes of Mal'ta and Buret'. The conditions of their discovery - inside the cave dwelling, alongside numerous weapons and tools and leftover bones - must obviously indicate the special role of women among the dwellers of Okumi Cave.

Early Paleolithic Site of Dmanisi and its Lithic Industry

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The 1980s witnessed the discovery of the Early Paleolithic site of Dmanisi, situated 85 km south of Tbilisi, on a rocky promontory at the confluence of the Pinezauri and Mashavera rivers (90 m above the rivers and 1000 m above sea level). The excavations provided the geological, paleontological and archaeological data to shed important light on the question of the earliest peopling of the region of modern Georgia.

The basalt lavas which underlie cultural deposits yielded a series of dates ranging from 2.04-1.80 Ma. The Early Pleistocene deposits can be subdivided into two units: lower unit A (layers VI to IV) and upper unit B (layers III to I). Layers VI to IV are characterized by normal polarity, thus they are dated to the end of the Oldowan paleomagnetic event, while layers III to I could have been deposited during the subsequent period of reversed polarity (Matuyama).

The faunal collection from the site includes over 7,000 animal bones belonging to Southern elephant, Etruscan rhinoceros, saber-toothed cat, Etruscan wolf, Etruscan bear, Stenon horse, deer, ostrich, giraffe, ox, terrestrial turtle, various rodents, etc. The majority of bones are from lower unit A. Some of them are strongly fragmented, while some lie in anatomical position. The fauna of Dmanisi is similar to the Villafranchian faunas of Africa and Eurasia. The lowermost layers contained skeletal remains of early hominids, identified as *Homo ergaster* (early *H. erectus*), including five skulls, four mandibles, teeth, and over 50 post-cranial bones. The total area of the site exceeds 5,000 m², while the area excavated is about 300 m². The excavation yielded over 10,000 lithics, of which 86% belong to layer II of upper unit B. The collection of stone artifacts consists of about 2,400 objects, while the rest of the lithics consist of pebbles and their fragments, pieces of basalt lavas, etc. Artifacts are made on tuff, basalt, porphyry, granite, quartzite, quartz, sandstone, limestone, etc., all of which are readily available in the environs of the site as river pebbles.

The assemblages of all layers are dominated by flakes and their fragments. Flakes with intentional retouch or notches are rare, while those bearing the traces of use retouch are more frequent. Cores are diverse, mostly unifacial, but there are also spherical and polyhedral cores with multidirectional scars. Pebble tools (choppers, chopping tools) constitute an important component of the industry. The lithic industry from different layers seems to be homogenous.

The Early Paleolithic industry from Dmanisi, dated to 1.8-1.7 Ma, represents one of the oldest cultural assemblages known outside of Africa. It has much in common with the industries from Kada Gona EG10 and EG12 (dated to about 2.55 Ma), Lokalelei 1 (ca. 2.34 Ma), Fejej FJ1 (about 2 Ma), etc. It also has analogies with the archaic stone industries of Olduvai Gorge (Bed 1 and Lower Bed II) and Koobi Fora.

Numerous finds from the European Mediterranean have shown that Southern Europe was populated by hominids as early as 1.3-0.78 Ma (Baranco Leon, ~1.3 Ma; Fuente Nueva 3, ~1.2 Ma; Elefante, ~1.1 Ma; Vallonet, ~1.0 Ma; Belveder di Monte Poggiolo, ~0.9 Ma, etc.)

The pre-Acheulean stone industry of Dmanisi is the earliest assemblage in Eurasia. Some other materials of similar age are known from the Near East. These and other data indicate the migration from Africa to the Near East and Caucasus and further to Europe and Asia. As evidenced by Dmanisi, southern Georgia was one of the passageways for the first migratory wave of early hominids.

The Modern Ichthyofauna of Vorotan River System

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Today, the native ichthyofauna of the Vorotan River is represented by: river trout *Salmo trutta fario* (common in head waters), riffle minnow *Alburnoides eichwaldi* (numerous), Kura bleak *Alburnus filippii*, Kura barbel *Barbus lacerta cyri*, mursa *Luciobarbus mursa*, Sevan khramulya *Capoeta sevangi* (=*Capoeta capoeta sevangi*) and Angora loach *Oxynemacheilus angorae* (=*Nemachilus angorae* =*Barbatula angorae*) (common).

Quite possible is the occurrence of: undermouth *Chondrostoma oxyrhynchum* (=*Chondrostoma cyri leptosoma*), chub *Squalius orientalis* (=*Leuciscus cephalus orientalis*), blackbrow *Acanthalburnus microlepis*, asp *Aspius aspius*, Kura khramulya *Capoeta capoeta capoeta*, Kura stone loach *Orthrias brandti* (=*Nemachilus brandti* =*Barbatula brandti* =*Oxynemacheilus brandti*), as well as carp *Cyprinus carpio* and catfish *Silurus glanis* (downstream).

Among the above-mentioned fish species, cyprinoids, *Alburnoides eichwaldi*, *Barbus lacerta cyri, Alburnus filippii* and *Capoeta sevangi* belong to relatively psychrophilic (cool water) species and generally occur in the upper and middle/lower reaches of the river. In the headwaters, river trout can be also found. It is worth mentioning that species closely related to them, such as *Salmo derzhavini*, *Salmo* sp. and *Alburnus sisianensis*, are found as fossil remains in the Early Pleistocene layers of the Vorotan River Basin. Accordingly, this points to relatively low temperatures in the environment at the time that the Sisian Formation was deposited.

Representatives of Fossil Fishes from Vorotan River Basin

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The Sisian Suite is one of the best studied localities of fossil fish remains in Armenia and is characterized by a low taxonomic diversity of fish. Up to now *Salmo derzhavini*, numerous remains of *Salmo* sp. and Sisian bleak *Alburnus sisianensis* have been found. It is rather surprising that fossil remains of *Salmo* sp. older than the Pleistocene have not been found in Armenia, as they are psychrophilic, preferring cool water. Trout seems to have appeared in the Vorotan River Basin during the Pleistocene when global temperature fell and glaciers formed. This is shown by the lack of remains of thermophilous fish species that are richly represented in Pliocene and Early Pleistocene sediments in Armenia. Thus, the Pliocene waters in Armenia were full of representatives of the cyprinoids *Leuciscinae*, *Barbinae* and *Cyprininae* that had penetrated there from the south and southeast. During the Late Pliocene the prevailing taxa were: *Alburnus gambariani, Leuciscus* cf. *souffia, Leuciscus* sp., *Leuciscus oswaldi*, as well as *Capoeta* sp. and *Garra* cf. *rufa* (Vasilyan, 2009). Considering the ecological characteristics of the contemporary, taxonomically closely related representatives of these species that prefer higher temperatures, we might assume that the climate of the Late Pliocene was warmer than now. The absence of such fish remains and the discovery of psychrophilic fossils of *Salmo* cf. *trutta* and Sisian bleak *Alburnus sisianensis* in the Pleistocene diatomaceous sediments of the Sisian Suite prove that the climate became colder than it was before the Pleistocene. After the last glaciation of the Late Pleistocene and as a result of the repeated rise in temperature in this region, the ichthyofauna of the Vorotan River entered its final development stage and acquired its present features.

In summary we conclude that the paleoclimate of the Vorotan River Basin was warmer in the Early Pleistocene than later on. This period was followed by several glacial periods, as a result of which, many thermophilous fish species disappeared or migrated towards more favorable habitats, for example, to the Hyrcanian refugium in the southern Caspian region. After deglaciation, some of these fish species again migrated back to their native habitats.

Early Pleistocene Environmental Changes in Southern Caucasus – Reconstruction of Climate and Vegetation Development in Western Georgia During the Gurian Stage

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The Caucasus is of crucial interest for understanding the history of the global climate system and its influence on regional vegetation and landscape evolution. Particularly, the late Early Pleistocene seems to play a major role in the establishment of the modern Ice Age world, when major faunal and environmental changes occurred during the Mid-Pleistocene climatic transition. Moreover, the Caucasus is the area of earliest human occupation in Eurasia, proven by findings of *Homo* fossils in Georgia with an age of ca. 1.8 Ma.

Pollen analytical data is used to integrate climate and vegetation data from different regions in the Caucasus in order to understand spatial differentiations of vegetation-climate relationships. Especially in this area with its strong relief, it is important to understand altitudinal differentiation of vegetation units and their shifts with climate change. For this purpose, the marine succession in western Georgia of Gurian age (ca. 1.8-0.8 Ma) was chosen as a reference section to compare data from the Armenian Highland with that of the western Georgian lowland. The materials from western Georgia stem from the former eastern coast of the Black Sea which stretched far into the Georgian mainland at that time. This coast was closely bounded by the mountain ranges of the Caucasus. In marine sediments pollen is accumulated from all types of the regional environment. Therefore, the pollen record covers the whole altitudinal range and can reveal information about altitudinal shifts of vegetation belts.

Future work will analyze quantitatively the existing data of Shatilova et al. (2002) for climate and vegetation reconstruction and will correlate it with the global climatic signal in order to gain a general picture of climatically driven shifts of the vegetation belts. Additionally, field work was conducted to take the new samples for palynology and correlate this information with the existing data of Shatilova et al. (2002). Those parts of the succession which show paleomagnetic reversals, and therefore allow for a precise age control, will be chosen for pollen analyses at a high resolution to allow for a more detailed understanding of the frequency and rate of vegetation shifts during single glacial/interglacial cycles. Furthermore, the flora will be analyzed using the Coexistence Approach (Mosbrugger and Utescher, 1997) to reconstruct the paleoclimate.

References:

Mosbrugger, V., Utescher, T., 1997. The coexistence approach - a method for quantitative reconstructions of Tertiary terrestrial palaeoclimate data using plant fossils. Paleogeography, Palaeoclimatology, Palaeoecology 134: 61-86.

Shatilova, I., Rukhadze, L., Mchedlishvili, N., Makharadze, N., 2002. The main stages of the development of vegetation and climate of Western Georgia during the Gurian (Euopleistocene) time by the pollen records. Bulletin of the Georgian Academy of Sciences, 166(3): 624-627.

Early Pleistocene Environmental Changes in Southern Caucasus - High-Resolution Vegetation Reconstruction in Southern Armenia During the Mid-Pleistocene Transition

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Lacustrine sediments in the Vorotan Basin (Armenia) have been examined palynologically. The results were used to reconstruct the vegetation history in the Southern Caucasus during parts of the Early Pleistocene. The sediments cover the beginning of the Mid-Pleistocene transition (1.11-0.96 Ma). Samples were taken from ten outcrops for pollen examination. The pollen profiles clearly show regional vegetation cycles during the Early Pleistocene. During interglacials an open forest with thermophilous deciduous taxa (e.g. *Quercus*, *Carpinus*, *Ulmus*, *Zelkova*, *Tilia*) prevails. During pronounced warming, grass steppe areas dominate, whereas forests are pushed back to northern slopes and riparian areas. During glacial phases conifers become increasingly important (e.g. *Tsuga*, *Abies*, *Picea*, *Pinus*), finally leading to a closed pine forest at the end of the first long lasting glacial of MIS 30.

It has become clear that the climate cycles differ significantly in terms of the character of their respective vegetation. Amplitude of warming as well as the duration of the phase play the most important role. Comparison with other investigations shows that vegetation cycles in the Southern Caucasus are in part completely different from those in the western, central and eastern Mediterranean regions.

The results have some consequences for the interpretation of early human dispersals out of Africa into Eurasia. It seems obvious that not every vegetation cycle is convenient for the expansion of human populations. In the Southern Caucasus there were suitable conditions with open landscape, vegetation mosaic and warm climate during pronounced interglacial phases. On the contrary, long lasting glacial phases brought about harsher conditions for *Homo erectus*.

As in southern regions of Europe the vegetation has been in part extremely different during certain climatic phases. The Southern Caucasus may have played an important role as a refuge for early humans. Vegetation changes at the transition from obliquity induced 41 ka cycles to eccentricity induced 100 ka cycles (Mid-Pleistocene transition) are shown very clearly by the results. These changes surely influenced human populations at that time and may have caused migrations and/or triggered adaptations.

The Role of the Western Georgian Refuge Zone on Expansion of Neanderthals and Anatomically Modern Humans: Impact of Tectonic and Volcanic Processes on Human Beings During the Middle and Upper Paleolithic

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The Caucasus was a migration corridor which periodically enabled hominin dispersals and migrations between Anatolia, the Near East, Europe and Central Asia. The Southern Caucasus, and especially Georgia, have yielded numerous Paleolithic sites dated to the Middle and Upper Pleistocene, located at the foot of the Greater Caucasus barrier. Among about 500 Paleolithic sites, 200 are represented in the Rioni-Kvirila basin, Imereti Region (refuge zone) in Western Georgia and South Ossetia.

Several cultural groups are based on local technological trends or on behaviors coming from other areas (Near East, Zagros, Eastern Europe). One of these, named Djruchula-Koudaro, groups sites from the Imereti and South Ossetia areas in northern and northwestern Georgia. These sites yields lithic assemblages with common traits, such as the proportion of blades and the use of bifacial retouch, in particular, to shape the tip of elongated artifacts.

Based on the study of the lithic industry and results of dating, we suppose that some kind of cultural influences from the Near East started during the Lower Paleolithic (Late Acheulean). Later, a local evolution of Middle Paleolithic culture, cultural influences from the Near East (Zagros) and Northern Caucasus, the merging of these different features and a local development of the culture took a place in the Middle Paleolithic. The goal of one of our projects is to research Neanderthal evolutionary history in the Caucasus and their replacement by Anatomically Modern Humans, which could result from natural catastrophes. We found evidence of paleo-earthquakes during the Pleistocene in some of the caves of Western Georgia.

In some caves the RESET project (RESponse of humans to abrupt Environmental Transitions) has carried out research on microtephras (i.e. distal ash fall from past volcanic eruptions) to correlate European and circum-Mediterranean geological, environmental and archaeological events over the last 100,000 years. One of the most interesting aspects of our research deals with refining the chronology of late Neanderthal and early Modern Human occupations in Europe between 60-25 ka BP by identifying tephra stratigraphic markers of known age and provenience and integrating these site datasets into high-resolution climate change records. In some Upper Paleolithic layers we have found microtephras which come from local volcanoes. This may have been one of the reasons of movement (local, long distance?) of some groups of humans.

Discovery and Research History of the Akhalakalaki Site

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The Akhalkalaki site was discovered in 1958 by the engineer-geologist, Tengiz Lazarashvili who brought several fossils to the Institute of Paleobiology in Tbilisi. It turned out that these fossils belonged to steppe mammoth and a large-sized deer. This discovery prompted the excavations of the Institute of Paleobiology guided by Abesalom Vekua, then a Ph.D. student at the institute. The rich and interesting faunal collection consisting of more than 4000 fossils was dominated by *Equus suessenbornensis*. Among the finds unearthed from the site was the first *Hippopotamus* discovered in the former Soviet Union. This fauna was subsequently described and analyzed by A. Vekua in his doctoral thesis "The Early Pleistocene Mammalian Fauna of Akhalkalaki" published in 1962.

Later on there was a new wave of interest in this site. Manana Gabunia began archaeological investigations there in 1992. Her interest was due to the abundance of Paleolithic artifacts found across the Akhalkalaki plateau, and of course due to the Early Pleistocene age and richness of the paleontological layer at the Akhalkalaki site. Hoping to discover evidence of early hominins in the region, she began conducting test excavations near Vekua's original excavations. These small excavations continued each summer until 1994. Indeed these excavations led to the discovery of six andesite artifacts associated with the fauna. Since those excavations, Akhalkalaki has made its way into the literature as one of the few Early Pleistocene archaeological localities known in the Caucasus. As a result a new international project in collaboration with American colleagues (D.S. Adler, C.R. Ferring, M. Tappen, C.C. Swisher III) and guided by the Archeological Research Center (M. Gabunia) was launched in 1995. The main goals were to expand the archaeological excavations of Gabunia; to collect new paleontological, sedimentological, and palynological samples for analysis; and to attempt to verify the archaeological nature of the site. Unfortunately no *in situ* artifacts were discovered during this field work, yet as a result of this research, the stratigraphy (lithostratigraphy, magnetostratigraphy and absolute dates) and taphonomy of the site have been refined.

Since 2012 Akhalkalaki entered into the scope of interest of the Senckenberg Research Institute project – "Early Pleistocene Environmental Changes in Southern Caucasus". This project tackles wider paleoenvironmental questions such as understanding the Early Pleistocene local environments of the Southern Caucasus as prerequisites for the first appearance of humans in this area. The project mainly focuses on vegetation and climate reconstructions based on plant fossils in this area for the time span from 2-1 Ma. Ecological studies of large mammals from Akhalkalaki are also under focus. In the framework of this project, the Akhalkalaki collection has been organized and paleoecological analysis has been conducted. Furthermore, survey, mapping and palynological sampling of the lacustrine sediments contemporaneous to the Akhalkalaki site have been conducted.

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