Developing International Geoarchaeology Conference 2013
and
International Workshop on Archaeological Soil Micromorphology

Basel, Switzerland, 2nd to 6th September 2013
1) Welcome Reception: Sunday 1st September; 17:00-19:30 PM; Dep. Altertumswissenschaften, Petersgraben 51, Main Entrance
2) International Workshop ASM: Monday-Tuesday 2nd-3rd September; “Schnitz” Room No. S01 & S02, Entrance: Rosshofgasse 2 (arrow)
3) Meeting point for the Excursion: Wednesday 4th September; 8:40 AM; in front of the „Kollegiengebäude” (main building), Petersgraben 50
4) DIG 2013 conference: Thursday-Friday 5-6th September; Auditorium No. HS001, „Kollegiengebäude” (main building), Petersgraben 50

WASM & DIG CONFERENCE 2013: LOCATIONS

tram station „Marktplatz” No. 6

bus station „Universität” No. 32
Monday 2nd of September

**Location:** Rosshofgasse 2, **Room:** “Schnitz”, Rooms S01 and S02.

08:00 – 08:30h Registration

08:30 – 08:45h Opening of the Workshop by Philippe Rentzel & Team

08:45 – 10:00h Microscopy session

10:00 – 10:30h **Coffee & Tea break, Poster session**

10:30 – 12:30h Microscopy session

12:30 – 14:00h **Lunch**

14:00 – 15:30h Microscopy session

15:30 – 16:00h **Coffee & Tea break, Poster session**

16:00 – 18:00h Microscopy session

Tuesday 3rd of September

**Location:** Rosshofgasse 2, **Room:** “Schnitz”, Rooms S01 and S02.

08:30 – 10:00h Microscopy session

10:00 – 10:30h **Coffee & Tea break, Poster session**

10:30 – 10:50 **R. Shahack-Gross:** Archaeological micromorphology inter-comparison “test”: Preliminary results.

10:50 – 12:30h Microscopy session

12:30 – 14:00h **Lunch**

14:00 – 15:30h Microscopy session

15:30 – 16:00h **Coffee & Tea break, Poster session**

16:00 – 18:00h Microscopy session
Excursion

Wednesday 4th of September

08:15h  Meeting point: In front of the “Kollegiengebäude” (main building) of the University of Basel (Petersgraben 50).

08:30h  Departure

Stop I: Dittingen – Schachtetetal
Quaternary outcrop in the Birs Valley (Swiss Jura) with periglacial deposits.

Stop II: Grellingen – Wachtels
Quaternary outcrop in the Birs Valley (Swiss Jura) with Late Palaeolithic and Late Mesolithic archaeological layers.

12:00h  Stop III: Ruin Pfeffingen & Lunch (packed lunch provided)
Medieval castle and geological overview of the Rhinegraben.

Stop IV: Muttenz Kiesgrube
Visit to a well-developed Holocene Luvisol in the Lower Terrace of the river Rhine.

Stop V: Kaiseraugst – Auf der Wacht
Visit to an ongoing excavation in the roman town Augusta Raurica.

Stop VI: Kaiseraugst – Schmiedmatt & Apéro
Visit to a commercial roman house. Questions concerning mortar and other construction material are addressed. The end of the journey will be closed with a small apéro.

Approx. 16:30h  Return to Basel
Developing International Geoarchaeology (DIG) – Conference

Thursday 5th of September

**Location:** Kollegiengebäude, University of Basel (Petersgraben 50).
**Room:** Auditorium No. HS001.

08:30 – 09:00h  
Registration

09:00 – 09:20h  
Opening of the DIG Conference by the head of the Geoarchaeology group at the University of Basel, PD Dr. Philippe Rentzel, and the Dean of the Faculty of Science, University of Basel, Prof. Dr. Jörg Schibler.

**Session I: Advances in Methodology**  
**Chair:** Christopher E. Miller

09:20 – 09:40h  
P. Goldberg: Making micromorphology more effective and prevalent in Geoarchaeology and Archaeology.

09:40 – 09:55h  
R. Shahack-Gross: Archaeological micromorphology inter-comparison “test”: Preliminary results.

09:55 – 10:15h  

10:15 – 10:35h  
K. Gilliland, T. C. Kinnaird & T. Gibson: Perceiving the Palaeoindian Period: Using sediment luminescence characteristics to expand understandings about the timing and nature of human occupation of the early landscape in the northwestern Lake Superior Region, Canada.

10:35 – 10:50h  
Poster presentations

10:50 – 11:20h  
Coffee & Tea break, Poster session

11:20 – 11:40h  
L. E. Hamlet: Land management and palaeo-landscape narratives from soil and sedimentary records: Can SEM address questions of resource management in Neolithic and Bronze Age Orkney?

11:40 – 12:00h  

12:00 – 12:20h  
X. Suarez Villagran: Microfacies analyses in monumental shell mounds from southern Brazil: applying multivariate statistics to identify recurrent processes of deposition.

12:20 – 12:40h  

12:40 – 14:00h  
Lunch
Session II: Current Research  
Chair: Roger Langohr

14:00 – 14:20h  D. Anesin & D. E. Angelucci: Stratigraphy, site formation and early use of fire in Europe: Cueva Negra (Caravaca de la Cruz, Spain).

14:20 – 14:40h  C. Mallol, A. Sistiaga, D. Cabanes, C. Hernández & B. Galván: Advances in microstratigraphic dissection of archaeological palimpsests: An example from El Salt Middle Palaeolithic Site (Alicante, Spain).

14:40 – 15:00h  A. Polo-Díaz, J. Martínez-Moreno, A. Benito-Calvo & R. Mora: Neanderthals and Modern Humans at Cova Gran de Santa Linya (South-eastern Prepyrenees): Some microstratigraphic contributions to the understanding of the Middle/Upper Paleolithic Transition in the Iberian Peninsula.

15:00 – 15:20h  A. Zanoni, M. Zeidi, Ch. E. Miller & N. J. Conard: Using floors and occupation surfaces to understand the settlement history of the aceramic tell of Chogha Golan, Ilam Province, Iran.

15:20 – 15:35h  Poster presentations

15:35 – 16:05h  Coffee & Tea break, Poster session

16:05 – 16:25h  S. M. Mentzer, J. Vasquez, V. T. Holliday & H. B. Martínez Izquierdo: The formation processes of Late Pleistocene and Holocene deposits in Sierra Diablo Cave (USA): Implications for the interpretation of biogenic materials in archaeological sites.

16:25 – 16:45h  A. Jones & M.-R. Usai: Case studies from the InterArChive Project.

16:45h  Ph. Rentzel Closing session.

19:00h  Social dinner at the restaurant “Parterre” (Klybeckstrasse 1b, Basel)
Friday 6th of September

Location: Kollegiengebäude, University of Basel (Petersgraben 50).
Room: Auditorium No. HS001.

Session III: Taphonomy and Preservation
Chair: Judith Becze-Deak


09:20 – 09:40h  E. Schulz: Regeneration of vegetation and soil after clearing, burning and cultivation. The Forchtenberg-Experiment.

09:40 – 10:00h  Ch. E. Miller, S. Mentzer, J. Parkington & G. Porraz: Site formation processes of the Middle Stone Age layers at Eland’s Bay Cave, South Africa.


10:20 – 10:50h  Coffee & Tea break, Poster session

10:50 – 11:10h  D. Vannieuwenhuyse: Lifeways of the first Australians project: a microscale geoarchaeological investigation of Pleistocene and Holocene archaeological sites in the Kimberley (North of Western Australia).

11:10 – 11:30h  G. Koromila: Site formation, taphonomy and preservation: a micromorphological analysis of open areas in three Neolithic settlements, N. Greece.


11:50 – 13:30h  Lunch

Block IV: Geoarchaeology of Wetlands
Chair: Francesco Menotti


14:30 – 15:00h  Coffee, Poster session

15:20 – 15:40h  
**J. Jotheri, T. Wilkinson & M. Allen:** *Reconstruction of ancient rivers in the Najaf wetland area – Southern Mesopotamia.*

15:40 – 16:00h  
**Y. Devos, C. Nicosia, L. Speleers & L. Vrydaghs:** *Geoarchaeology and (pre)-urban wetland archaeology: Some case studies from Brussels (Belgium).*

16:00h  
**L. Wilson:** Closing session. Summary and outlook.
Abstracts
Making Micromorphology More Effective and Prevalent in Geoarchaeology and Archaeology.

Paul Goldberg

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At the Cambridge DIG conference in 2007, Richard Macphail and I tried to outline some pointers about improving micromorphological interactions among archaeologists and specialists, and conveyed some ideas about data and how to present them. Things have improved since then, but micromorphology is still incredibly underutilized as a fundamental technique in geoarchaeology, and in archaeology as a whole. In this paper I present some suggestions to ourselves in order to promote the technique and have it more widely incorporated into the mainstream of archaeological research.
Archaeological micromorphology inter-comparison “test”: Preliminary results.

Ruth Shahack-Gross

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An inter-comparison exercise has been carried out among practitioners of archaeological micromorphology between July 2011 and May 2013. Participating practitioners cover variable backgrounds and differ in experience. The exercise was designed to test whether several basic materials often encountered in thin sections are readily identifiable by the community, using petrography only. The exercise included 12 thin sections of known materials (bone, wood ash, dung, shells, charred plant materials, humic substances, oxides and a variety of rocks). Over thirty people participated. Results were calculated for test forms in which participants attempted to answer 50% or more of the questions (n=29). Each participant was asked to identify the general material, and in certain cases more specific questions about mineralogical composition have been included. Results were calculated in percentages of correct answers/identifications. The highest personal scores were in the order of 70% correct answers. A learning curve is identified among students (0-4 years of experience; scores vary between 15-65%), while among post-PhD researchers there does not seem to be a correlation between years of experience and score (learning ‘saturation’; scores vary between 50-70%). Test questions included identification of materials (e.g., bone, dung, wood ash, granite) and their mineralogical composition (e.g., in granite: quartz, mica and feldspar). Overall, identification was better among archaeological materials than among geogenic materials (i.e., rocks). Mineralogy is generally poorly known. Participants commented that the “test” was difficult, mostly on the grounds of lack of contextual data. Success rates may also relate to knowledge of a variety of geographical/environmental areas. Most participants work in European contexts while the test was somewhat biased to West Asian materials and Mediterranean preservation conditions. Other difficulties in the test include deciphering participants’ hand writing, and difficulties determining how correct or incorrect a partial answer is. Yet, this pilot test is useful for identifying strengths and weaknesses in material identification using petrography only. These will be detailed in the presentation, along with a few suggestions for future work and tests.
The Schöningen hearths: Perspectives on multidisciplinary geoarchaeological research and Middle Pleistocene fire use in northern Europe.

Mareike Stahlschmidt\textsuperscript{1,*}, Christopher Miller\textsuperscript{1}, Paul Goldberg\textsuperscript{1,2}, Bertrand Ligouis\textsuperscript{1}, Francesco Berna\textsuperscript{3}, Daniel Richter\textsuperscript{4}, Ulrich Hambach\textsuperscript{4}, Jordi Serangeli\textsuperscript{1} & Nicholas Conard\textsuperscript{1}

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\textsuperscript{2} Boston University, Department of Archaeology
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Purported hearth features at Schöningen 13 II-4 have been proposed to present the oldest secure evidence of human control of fire in the Middle Pleistocene of Northern Europe (Roebroeks and Villa 2011; Thieme 1997). We conducted a multidisciplinary study to analyze these features using micromorphology, organic petrology, Fourier transform infrared spectroscopy, mineral magnetic parameters, luminescence studies and a heating experiment. The analyses show that the different methods complement one another well and clearly demonstrate that the purported hearth features at Schöningen are not heat related. Our results question assumptions about the necessity of fire for the early settlement of cold, northern latitudes by hominins.

References:
Perceiving the Palaeoindian Period: Using sediment luminescence characteristics to expand understandings about the timing and nature of human occupation of the early landscape in the northwestern Lake Superior Region, Canada.

Krista Gilliland1*, Timothy C. Kinnaird2 & Terrance Gibson1

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Extensive rescue excavations at eight sites along a relict shoreline in the northwestern Lake Superior region, Ontario produced thousands of lithic artifacts in unusually early contexts, making this group of sites unique in their potential to impact current understandings of the region’s occupation history. Typologically, the artifacts appear to belong to the Lakehead Complex, assumed to date to the Palaeoindian period (i.e. 8000 years before present or earlier). However, this assumption is problematic as, until recently, the Lakehead Complex has never been dated using in situ materials. To that end, a program of optically-stimulated luminescence and AMS radiocarbon dating was undertaken to produce a chronological framework for the sites.

Unexpectedly, most of the ages produced are situated in the middle Holocene. To assess the validity of our chronology, we undertook luminescence profiling in both field and laboratory contexts, identifying several discrete packages of sediment that have stratigraphic integrity and are laterally consistent across the landscape. Additionally, obtained stored dose estimates suggest the potential for extending the site chronology into the early Holocene period. These results indicate the reliability of our existing chronology and demonstrate the fundamental importance of luminescence profiling in assessing depositional characteristics as a companion to chronometric dating.
Land management and palaeo-landscape narratives from soil and sedimentary records: Can SEM address questions of resource management in Neolithic and Bronze Age Orkney?

Laura E. Hamlet

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Since the Neolithic period (6000 years ago in Britain) people have been practicing arable and pastoral agriculture but the development of land management techniques remains poorly understood. At the Links of Noltland, Orkney, buried soils and associated field systems related to Neolithic and Bronze Age settlement survive beneath a dune system now being destroyed by erosion. Such a degree of preservation of both archaeological remains and associated soils is exceptional and so a range of scientific techniques are being applied to establish the formation processes of anthropic sediments and anthroposols in order to give new understandings of the complex relationships between land resource management and use of domestic wastes in an environment of sand movement. Thin section micromorphological analysis has been applied to domestic and cultivated contexts but the diversity of inclusions and degree of biological reworking make feature identification and interpretation problematic. Scanning Electron Microscopy has been successfully applied to support micromorphological interpretations and refine understanding of the origins of key features and post-depositional processes affecting sediments. Rigorous examination of the organization, formation and redistribution of anthropic sediments across this landscape is contributing new understandings of land and resource management and resilience at Links of Noltland, with wider resonances for Neolithic and Bronze Age landscape in northern Europe.
A question of scales: How micromorphological study and micro-CT scanning of soil samples reveal subsistence strategies in Neolithic Swifterbant (NL).

D.J. (Hans) Huisman1*, Dominique Ngan – Tillard2, F. Laarman3 & Daan C. M. Raemaekers4,

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Neolithic archaeological sites on former levees in the Swifterbant area (NL) used to be seen as typically representation of the transition from nomadic hunter-gatherer to sedentary agricultural subsistence (c. 4300-4000 calBC). New research gave a different view of site use and landscape exploitation.

Soil micromorphological work revealed that black deposits that were thought to be clayey, refuse-rich settlement layers were in fact midden deposits that consist almost exclusively of laminated carbonized plant remains and phytoliths, with many bone fragments and occasionally coprolites. Micro-CT scans of soil samples and impregnated blocks showed that these deposits were extremely rich in fish bones from freshwater fish, whereas coprolites contained marine and andromous fish species - which must have come from > 50 km to the west. At least 5 horizons were identified – in clay and in refuse deposits – that had been tilled using some form of hand tool (e.g. hoe).

These results do not only reveal how the Swifterbant people utilized the landscape - and its resources - for subsistence; it also shows that agriculture played a stronger role than previously thought.
Microfacies analyses in monumental shell mounds from southern Brazil: applying multivariate statistics to identify recurrent processes of deposition.

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Shell mounds, locally known as sambaquis, are the most frequent archaeological sites along the coast of Brazil. In the southern State of Santa Catarina shell mounds reach monumental sizes: more than 4 m in height and 300 m in diameter. In this study, microfacies (mF) analyses were conducted in stratigraphic successions from four shell mounds located in Santa Catarina State. The analyses of 15 thin sections allowed the identification of 23 mF. Several mF are recurrent along the same stratigraphic succession and are even observable in the thin sections from different sites. To identify the intra and inter site recurrence of mF, principal components analyses (PCA) were done using the percentage of main parameters in mF identification as variables: 1) shell content; 2) bone content; 3) mineral grains; 4) porosity; 5) and fine fraction. The scatter plot showed four major groups and two outliers. The four groups reveal the repetition in time and space of depositional processes related with the formation of the shell mounds. Analyses show that, despite their great size, a single depositional behavior is responsible for most of shell mound formation: the massive deposition of discarded food and hearth residues.
An Ethno-Archaeological Study of Cooking Installations in Rural Uzbekistan and an application in archaeological sites in Israel.

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Mud constructed cooking installations are prevalent in archaeological, pre-modern and modern settlements in the Near East. Archaeological cooking installations are mostly identified based on resemblance in shape and size to ethnographic installations. In the study presented here we establish direct evidence to the use of fire in such installations and address questions related to fuel identification. An ethnoarchaeological study was conducted in rural households near Samarkand, Uzbekistan. Field work included temperature measurements during cooking experiments using different installations and fuel materials (e.g. wood and dung). Samples were collected from installations walls, and from fresh and charred fuel materials, and analyzed using geoarchaeological methods. Exposure to high temperatures was identified on installations’ interior walls only. Operating temperatures do not correspond with actual baking or cooking temperatures. A new method for quantification of ash pseudomorphs and dung spherulites was developed in order to determine the proportions of wood and dung used as fuel. These new developments have been applied to archaeological mud constructed cooking installations from various Bronze and Iron Age sites in Israel.
Stratigraphy, site formation and early use of fire in Europe: Cueva Negra (Caravaca de la Cruz, Spain).

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Cueva Negra (aka Cueva Negra del Estrecho del Río Quípar, Caravaca de la Cruz, Murcia, Spain) is a key-site for understanding the first human peopling of Europe. Archaeological research has shown that this rockshelter is filled with a succession that pre-dates the Matuyama-Bruhnes paleomagnetic inversion (thus older than 780 ka bp), which contains mustero-levallois lithic assemblages (also featuring a hand-axe) and abundant faunal remains.

In this paper, we present novel data on the stratigraphy and formation processes of the Pleistocene succession of Cueva Negra, based on recent field and soil micromorphological observation. The data show that the succession is mainly formed of alluvial sediments with minor inputs from the cave, and that its accumulation took place quite fast, as it is demonstrated by the moderate evidence of soil formation and post-depositional disturbance – despite the Lower Pleistocene age of the deposit.

We will also present the first microstratigraphic and micromorphological data on the thermal alteration features that are found in the lowermost part of the succession, showing that they result from in situ combustion and that they could represent one of the earliest evidence for the use of fire in Europe.
Advances in Microstratigraphic Dissection of Archaeological Palimpsests: An example from El Salt Middle Palaeolithic Site (Alicante, Spain).

Carolina Mallol1*, Ainara Sistiaga1, Dan Cabanes2, Cristo Hernández1 & Bertila Galván1

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We present results from ongoing microstratigraphic investigations at El Salt (Alicante, Spain), a rich Middle Palaeolithic site that has yielded numerous well preserved combustion structures. We are exploring these using different techniques: Soil micromorphology, FTIR, GC/MS and phytolith analysis. Here, we focus on the case of combustion structure H44, which in the field was considered to be a single hearth. However, our integrated microstratigraphic data show a complex sequence of events whose reconstruction brings us closer to an ethnographic time scale from which to approach their associated human occupations. Our observations include the identification of a dismantled fire made on a vegetated soil, an abandonment period involving plant growth, and renewed burning and deposition of human feces. These results provide crucial information regarding formation of the H44 combustion structure and highlight the complexity underlying Palaeolithic anthropogenic deposits.
Neanderthals and Modern Humans at Cova Gran de Santa Linya (South-eastern Prepyrenees): Some microstratigraphic contributions to the understanding of the Middle/Upper Paleolithic Transition in the Iberian Peninsula.

Ana Polo-Diaz1*, Jorge Martínez-Moreno2, Alfonso Benito-Calvo3 & Rafael Mora4

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The decline and final extinction of the Neanderthal population together with the expansion of Modern Human groups across Western Eurasia are considered to be parallel processes.

The Middle/Upper Paleolithic cultural transition (M/UPT) is currently subject of intense discussion, in which interdisciplinary approaches to the analysis of sites with evidence of Neanderthal and Modern human occupation have become crucial.

Sedimentological evidence for the identification of the cultural and environmental dynamics involved in the depositional and post depositional formation processes of the M/UPT at the site of Cova Gran de Santa Linya is provided by micromorphological analyses.

Specific weight, distinctiveness and distribution of anthropogenic and pedogenic features along the stratigraphic sequence yield contextual data for the artefactual assemblage recovered at the site and allow discussion of the settlement patterns of Neanderthals and Modern Humans during the M/UPT in the Iberian Peninsula.
Using floors and occupation surfaces to understand the settlement history of the aceramic tell of Chogha Golan, Ilam Province, Iran.

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In the last decades advances in the micromorphological analysis of sediment thin sections have demonstrated how observation of archaeological and geological deposits at the micro-scale provide important information for understanding how archaeological sites formed. These advances have been particularly important for identifying and interpreting past occupational surfaces. For this reason, during the excavation in 2010, the team of the Tübingen Iranian Stone Age Research Project (TISARP) collected 10 block samples at the aceramic Neolithic tell site of Chogha Golan, located in the foothills of the Zagros Mountains in the Ilam Province of Iran. Here, the field crew excavated an 8-m-deep stratigraphic sequence characterized by plastered floors and the remains of mud-brick walls, along with vast assemblages of nearly all kinds of archaeological material. Radiocarbon dates from Chogha Golan fall between 11700 to 9600 cal. BP.

The micromorphological analyses provide important new insights into the specific anthropogenic and geogenic processes that are recorded at the site. This work uses the floors and past occupational surfaces as anchors for interpreting the events that shaped the development of this important, early aceramic tell.
The formation processes of Late Pleistocene and Holocene deposits in Sierra Diablo Cave (USA): Implications for the interpretation of biogenic materials in archaeological sites.

Susan M. Mentzer\textsuperscript{1,2*}, Jose Vasquez\textsuperscript{3}, Vance T. Holliday\textsuperscript{2} & Haydar B. Martinez Izquierdo\textsuperscript{1}

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Sierra Diablo Cave is a cavity formed in the Sierra Diablo Mountain limestone of west Texas (USA). The site contains Late Pleistocene paleontological deposits, as well as evidence for human utilization during the Paleoindian and Archaic periods. The excavated sequence contains multiple stratigraphic units that formed primarily as a result of natural processes. Micromorphological analyses reveal at least two phases of aeolian inputs into the cave, with localized reworking of sediment by water. Biogenic inputs include an intact layer of herbivore dung, burned fibrous and woody plant tissues, and guano. These materials are unrelated to human activity, yet they are similar to stabling layers and combustion features at other sites. Several periods of non-deposition are evidenced by buried surfaces exhibiting weathering crusts and phosphatic alteration. The textural features and mineralogy of the deposits indicate that the internal cave environment changed over time from periodically wet to exceptionally dry, with current arid conditions and abundant secondary nitrate minerals contributing to the preservation of a surficial deposit of Late Archaic-age organic materials that includes textiles and wood products. Here, we present the results of the micromorphological, mineralogical and isotopic analyses, and place our observations into a broader archaeological and paleoenvironmental context.
Case studies from the InterArChive Project.

Andrew Jones\textsuperscript{1*} & Maria-Raimonda Usai\textsuperscript{1}

\textsuperscript{1} University of York, Department of Archaeology

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By integrating several aspects of ego archaeological science, the InterArChive project seeks to maximize the potential information archaeologists can glean from human burials. Soil micro morphology, organic chemical analysis of soil samples and more conventional analysis of macro fossils and microfossils together with careful study of cultural materials have enabled the team to gain new insights into taphonomic processes occurring in graves.

Critical to the success of the project has been detailed study of control samples taken close to the burial, and valuable insights are coming from modern burials of pig carcasses.

This paper will concentrate on the results obtained from excavations of a large Roman and medieval cemetery in York, UK, Hungate.

Here human burials are located close to other features, e.g. rubbish and cess pits. By combining organic chemistry, soil micro morphology and microfossils analysis on the same burial and its surrounding soil matrix new understanding of bone diagenisis, the movement of organic molecules through the soil have emerged.
Taphonomy and preservation of phytoliths: A quantitative approach.

Ruth Shahack-Gross1*, Dan Cabanes2 & Steve Weiner1

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It has long been recognized that opaline phytoliths undergo a variety of taphonomic processes, including breakage and dissolution. Mechanical breakage has been studied previously, especially with regards to survival of conjoined cells (i.e., silica skeletons or multi-cellular phytoliths). Here we will present recently conducted chemical experiments that quantified the extent of phytolith dissolution and its effect on morphotype assemblages. We found that modern phytoliths have about the same range of solubility regardless of plant species, and that chemical dissolution mostly affects delicate phytolith morphologies (such as hairs, stomata and papillae). In addition, we developed a method that allows determining quantitatively the state of preservation of archaeological phytolith assemblages. Using this method we found no correlation between phytolith state of preservation and archaeological periods, rather, we show that phytolith preservation in archaeological sites depends on climatic conditions, sediment pH, and rapidity of burial. The latter observation relates to the terrestrial silicon cycle. This study contributes to better understanding of the taphonomy of phytolith assemblages, and offers means for selection of the better preserved samples, those that will yield the most reliable and complete morphotype and quantitative data.
Regeneration of vegetation and soil after clearing, burning and cultivation. The Forchtenberg-Experiment.

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The “Forchtenberg” multidisciplinary experimental program on the early steps of cultural landscape development in Central follows two research lines. Experiments include clearing, burning, cultivation as well as the documentation of succession lines of vegetation and soil. Secondary successions after the end of cultivation are visible in two different ways: The classical “Forest line” includes the settlement by grasses and herbs followed by a shrub cover, its topping by pioneer trees or by re-growing of them leading to a new tree layer. A “Ruderal line”, however, is characterised by a monotypic colonisation of high forbs- like Eupatorium, Epilobium or mostly Cirsium, which impedes the development of a shrub cover for a longer time span: about four to five years.

Within the topsoil/soil surface successions charcoals have a different fate: Either they are displaced vertically by earthworms and thinned out or they are concentrated to charcoal horizons near the surface by Enchytreas, collemboles and mites and weathered in situ. This second model may influence the ordinary reflections on age. “The deeper the older” is not always working.

Moreover, charcoals well indicate the Ap-horizons in the Situation of repeated cultivation with moderate tillage typical for slash and burn-systems.
Site formation processes of the Middle Stone Age layers at Eland’s Bay Cave, South Africa.

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Eland’s Bay Cave is located on the West Coast of South Africa, ca. 180km north of Cape Town. The site is well-known for its rock art and large Later Stone Age (LSA) shell midden that was excavated in the 1970s.

Excavations recommenced at the site in 2011, focusing on the Middle Stone Age (MSA) deposits located below the LSA shell midden. The goal of these limited excavations was to reassess the MSA lithic assemblages at the site and to collect samples for OSL dating and geoarchaeological investigation.

Here we report on our micromorphological and FTIR analysis of the sediments. Our results show that spalling (likely salt-induced), wind, and human activities were the main depositional agents acting at the site. Despite localized evidence for bioturbation, the preservation of combustion features demonstrates that the MSA deposits are relatively intact. However, the deposits have been significantly influenced by post-depositional chemical alteration as evidenced by the formation of gypsum, secondary phosphates, and the dissolution of ashes and bone. The chemical diagenesis at Eland’s Bay Cave is spatially and stratigraphically variable, allowing for a diachronic reconstruction of post-depositional alteration processes acting at the site.
Landscape evolution, taphonomy and Palaeolithic archaeology in Southwest Saudi Arabia.

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Reconstructing the landscapes inhabited by Palaeolithic populations presents a number of challenges. Primarily, differential preservation and exposure of sites at both landscape and local scales biases the observed archaeological record. Only by developing robust models of landscape evolution can the taphonomic constraints of the record be fully assessed, and integrated into its interpretation. Variability in taphonomy across sites is not necessarily negative as artefacts preserved in different sedimentological settings provide different types of information: location of surface scatters allows spatial analysis, whilst stratified sites can be dated and contain palaeoenvironmental information. As landscapes evolve, so do the opportunities and challenges they present to the occupations inhabiting them. Understanding long-term landscape evolution is therefore key to unravelling relationships between human populations and their landscapes.

This paper presents the preliminary results of geoarchaeological survey carried out in 2012-13 in Jizan and Qunfudah regions, SW Saudi Arabia. Key in debates surrounding dispersals of Palaeolithic populations from Africa via the Southern Red Sea, the Palaeolithic record of the region is poorly understood. Using satellite imagery areas of potential preservation and visibility of Palaeolithic sites, as well as key geomorphological features, were identified and targeted for investigation. In the field, Palaeolithic artefacts were recorded in a number of locations and geographical settings and these sites are placed within the developing model of landscape evolution. Preliminary hypotheses of hominin landscape use are outlined which will be tested through future survey, ultimately allowing assessment of factors controlling hominin occupation and dispersal.
Lifeways of the first Australians project: a microscale geoarchaeological investigation of Pleistocene and Holocene archaeological sites in the Kimberley (North of Western Australia).

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Australia was colonised by people over 50,000 years ago and some of Australia’s earliest occupation records are found in Northern Australia in sites such as Carpenter’s Gap and Riwi. The technologies and resource management needed to live in the arid heart of Australia, particularly during the Last Glacial Maximum when conditions were even drier, has been a major discussion area in Australian archaeology. A number of Kimberley caves and rock shelters containing Pleistocene and Holocene archaeological sequences have been re-investigated in 2012 and 2013, as part of the multi-disciplinary project “Lifeways of First Australians”. Several questions related to the relationship between environmental changes and human behaviour in arid environments have been raised by archaeologists, including sediment anthropogeogenesis, hiatuses, taphonomy and preservation. Geoarchaeological studies are very few throughout Australia and it’s the first time that a micromorphological approach is undertaken in this area. This analysis will help better understand site formation processes and contribute to a palaeoenvironment reconstruction at each site. An overview of the project and some of the preliminary results of the geoarchaeological investigation will be presented.
Site formation, taphonomy and preservation: a micromorphological analysis of open areas in three Neolithic settlements, N. Greece.

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Taphonomy and preservation of sediments and materials is generally expected to vary between persistently occupied sites, such as tells, and more dispersed and short-lived sites, such as flat/extended settlements, due to differential rates of sedimentation and intensity of space use. In the Neolithic of SE Europe these two major site types co-exist and thereby provide an important data set for comparative analysis.

This paper explores the nature and significance of variation in site morphology, formation processes and taphonomy at three different types of Neolithic settlements in N. Greece: the tell site Koutroulou Magoula, the tell-like site Paliambela Kolindros, and the flat/extended site Avgi Kastoria. Exterior areas from each site are being analysed, as these are an important forum for activities beyond houses. Moreover, open areas are least likely to be regularly and formally maintained and therefore provide less truncated indicators of both natural and anthropogenic site formation processes. Employing micromorphology, this comparative study investigates depositional pathways, from primary activity traces, like in situ burning, to secondary deposition, and key post-depositional factors, like bioturbation, weathering, and trampling. It provides new insight into how activities are represented in the archaeological record, and assesses the preservation potential of the examined site types.
A soil micromorphological study of the early medieval dark earth of Antwerp (Belgium).

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The early developments of Antwerp are still poorly understood and subject to ongoing research. During excavations on the right bank of the river Scheldt in 2008-2009, archaeologists discovered the remains of a 9th to 10th-century early town, surrounded by an earthen rampart and palisade. Beneath the 9th-century structures a Dark Earth – a thick, dark-coloured, humic, non-peaty and homogeneous layer – has been observed, covering in situ traces of Roman age. Soil micromorphology, combined with a phytolith study and granulometrical analysis, has proven to be a useful tool for the understanding of the complex site stratigraphy. It has allowed the identification of a series of activities that are often hard to distinguish based solely on field data. The study of the Dark Earth established that its formation is the result of a complex interplay of human activities and natural phenomena. Main human activities include ground raising, long lasting crop growing, possibly in combination with episodes of pasture. The study of the layers on top of the Dark Earth allowed identification of remains of a stable. Moreover, taphonomic processes such as a progressive wetting of the site, possibly related to a significant sea level rise, have been observed.
Micromorphology of the site of Mwanganda’s Village Area I, northern Malawi.

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The Mwanga’s Village site, northern Malawi, was first excavated in 1965-6 under the direction of J. D. Clark who reported the recovery of early MSA stone tools in possible association with the remains of an elephant.

Renewed investigations led to the discovery and excavation in 2011-2 of an in situ accumulation of terminal MSA artefacts on a higher stream terrace ca. 60 m southeast of Clark’s site.

We employ micromorphology to reconstruct a detailed site formation history of the terminal MSA site. The base of the sequence is marked by laminated lagoonal clays that have been truncated and overlain by a deposit of coarse alluvial sands. The artefacts are concentrated on and above a cobble layer, likely representing channel lag.

Micromorphological analyses also indicate a complicated sequence of post-depositional features associated with an ancient water table and long-term pedogenesis. These features include Fe-Mn oxides, carbonate nodules, vertic stress cutans, bioturbation and secondary silica. The results of our study allow us to test models of paleoenvironmental change near Lake Malawi. The association of terminal MSA artefacts with depositional and post-depositional features associated with riparian environments underlies an emerging pattern of evidence for wetland adaptation during the MSA in central Africa.
A Neolithic house with the whole shebang? Taphonomic aspects of the wetland site Cham-Eslen (Canton Zug, Switzerland).

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Taphonomic analyses carried out on wetland settlements illustrate just how much evidence is missing from dryland settlements. Moreover, various opportunities exist in the areas of macroscopic and even more so of microscopic analysis.

These are outlined using the lakeside settlement of Cham-Eslen as an example. The settlement is suitable in many ways for taphonomic examinations: the site consists of a single house, which was situated on an island (today submerged in the lake) and according to dendrochronological dates was probably inhabited for approximately 10 years. It has yielded well-preserved and unusual finds.

From a macroscopic point of view, the distribution patterns of the heavier finds are used to ascertain what might be considered in situ (in other words, still located where they were originally deposited). Microscopically, micromorphology is used to ascertain the state of preservation. Different areas with various stages of preservation were identified in the samples by applying several criteria including the absence of limnic elements and bioturbation traces as well as the presence of ash and evidence of trampling. A number of deeper probes served to investigate whether the site is, in fact, an island or whether it is the product of a process of erosion.

The results revealed that the house in Cham-Eslen was built on a dry island, the centre of which was not affected by flooding during its occupation. Therefore, we may assume that the features in this area have survived in situ. However, the outer areas of the house do, in fact, show traces of regular soil disturbances.

References:

(Translation: Sandy Hämmerle, Galway, Ireland)
The central mound in the Neolithic lakeside settlement of Marin- Les Piécettes (Neuchâtel, Switzerland): site formation processes.

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The settlement of Marin- Les Piécettes, dated to 3500 - 3400 cal. BC, is located on the northern shore of Lake Neuchatel, near the famous La Tène site. Focusing on the sequence of a large mound, on which a central building was erected, the micromorphological analysis of this mostly anthropogenic accumulation has identified lacustrine deposits, daub fragments or organic refuses sometimes compacted by trampling. The formation and function of these layers, which are closely linked with the building, have been established. The analysis permits as well to reconstruct the chronology of the main events which affected the site: these suggest a long period of occupation interspersed with transgressions from the lake, and interrupted by dwelling destruction phases followed by reconstruction.
Geoarchaeology of the hydraulic structures of the Bronze Age site of Fondo Paviani (Verona, north-eastern Italy).

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The late-final Bronze Age (14th-12th century BCE) site of Fondo Paviani covers an area of ca. 20 ha and is surrounded by a moat and by a quadrangular earthen rampart. The site is located in the lowlands south of Verona, in the “Valli Grandi Veronesi” area. Fondo Paviani lies within the relict valley of the Menago river, one of the terraced valleys resulting from the Holocene incision of the late-Pleistocene fluvioglacial fan formed by the outwash of the Garda glacier (the so-called “ancient Adige alluvial fan”). A series of wide stratigraphic exposures, integrated by auger observations, allowed to investigate the interior of the site, the earthen rampart, and the valley outside the site. The fill of this valley, made up by ca. 2m of organic sediments, was exploited to gather information on the palaeo-environmental conditions before the settlement, during its life, and after its abandonment. Our palaeo-environmental reconstruction is based on field stratigraphy, radiocarbon dates, archaeobotanical analyses, thin sections and physico-chemical analyses.
Reconstruction of ancient rivers in the Najaf wetland area – Southern Mesopotamia.

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This research is concerned with the late Holocene floodplain development in a wetland area that lies around Najaf City, 40km south west of ancient Babylon in Iraq. The particular focus is the pattern of river avulsion during floodplain development, and its relation to the survival or persistence of ancient settlements. The research was carried out by a combination of geological, geomorphological, remote sensing, historical, archaeological approaches, including fieldwork. Landsat, SRTM, CORONA and Digital-globe satellite images were interpreted by using ArcGIS software to determine the surface expression of abandoned channels and archaeological mounds. In addition, the historical documents including Arabic texts from the 9th-14th century and European travel literature from the 16th-early 20th century were reviewed. The fieldwork included “groundtruthing” of the remote sensing work, and drilling boreholes (between 1-12 m) for sampling and geological documentation.

As a result, more than three ancient courses of rivers have been identified and dated for the first time in this part of the Mesopotamian floodplain. The periods of these avulsions can be dated to between 1500 BC and 636 AD, according to the periods of the associated archaeological sites. It is suggested that causes of shifting of these channels were natural silting, and/or human interference. However, the tendency of rivers to change their courses still exists and can be detected in the active rivers in this area.
Geoarchaeology and (pre)-urban wetland archaeology: some case studies from Brussels (Belgium).

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Over the last decade geoarchaeological research focussed on the study of Dark Earth, on the dryer, topographically higher part of Brussels (Devos et al., 2011). The present contribution, however, will focus on the sites situated at the bottom of the alluvial valley of the Senne river. Through a series of case studies, the potential of geoarchaeological investigations in this area will be highlighted and confronted with the results obtained for the higher parts of the city. Several points of interest will be discussed: the characterization of formation processes and the evaluation of the preservation of organic remains and ecofacts, the identification of human activities, the understanding of the urban landscape and the urbanisation process.

Reference:
Posters
Dynamic Late Glacial landscapes and their impact on the archaeological record of the Ach and Lone valleys of southwestern Germany.

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The Ach and Lone valleys of the Swabian Jura, in the State of Baden-Württemberg (southwest Germany), represent two key areas for the research of Pleistocene and early Holocene human history. Excavations have documented deep archaeological sequences and spectacular finds that have improved our knowledge about the relation between endemic Neanderthals and modern humans, who migrated into Europe ca. 40,000 years ago.

Gullies and rills within the caves of Hohle Fels (Ach Valley) and Hohlenstein (Lone Valley) document stratigraphic discontinuity in the archaeological records between the Gravettian and Magdalenian. Thick colluvial infilling of the caves suggest that drastic changes in environment and landscape took place after the LGM.

Here we aim to reconstruct the natural processes that led to these changes in the two valleys and to examine how these changes in sedimentation within the caves shape the record of human occupation in the region. Using geological and geomorphological surveys, geophysical prospection and micromorphology, we have been able to define the depth of Pleistocene deposits. Additionally we have collected evidence on formation of terraces and the migration of the river drainages. We have also been able to distinguish between phases of alluvial from colluvial deposition, and have addressed the potential for the discovery of new archaeological sites.
Palaeoenvironments of a Late Palaeolithic site, Verőce, Hungary.

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Complex geomorphological, geological, palaeopedological-micromorphological and chronometrical investigations were elaborated to reveal the development of the alluvial section and the loess-paleosol sequence containing the remains of a Late Palaeolithic site near Verőce, Hungary.

Before the World War II archaeological artefacts were collected in the quarry. According to the documentations the lithics were found in the uppermost loess layer of the brickyard. The archaeological typology suggest for an Epigravettian blade industry. At the same time, traces of fire, interpreted as fireplaces were also observed at several points. Based on the 14C dating (22-20 ka BP) of a charcoal horizon in upper part of loess section the Palaeolithic site dated back to a warmer period of Late Pleniglacial (marine isotope stage, MIS2).

Signs of different palaeoenvironments were identified in the profiles of the brickyard, indicated complex palaeogeographical system in the margin of alluvial (indicated by terrace gravel, different kind of alluvial sediments and a weak, organic material horizon) and proluvial (e.g. sheet wash indicated by fine layered, redeposited sediments) area and the climate cycles of Pleistocene (characterized by glacial/stadial loess and intercalated interglacial/interstadial paleosols).

The presence of the Epigravettian industry was the final phase in the Pleistocene history of the area.
Burial or waste? Geoarchaeological investigations of an infilled storage cellar containing skeletons of a newborn and two foetus in the Late Iron Age settlement “Basel-Gasfabrik” (Switzerland).

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“Basel – Gasfabrik” was an unfortified Late La Tène (Late Iron Age; 150-80 BC) settlement situated north of Basel on the Lower Rhine Terrace. The site covers about 150’000 square meters and contains two cemeteries with more than 170 inhumations. Additionally, several complete skeletons have been found inside the settlement in pits as well as several hundreds of isolated human bones scattered throughout the entire settlement. The site was discovered in the year 1911 and was excavated during decades until 2012.

The so-called “Pit 283” – a presumed storage cellar – is located within the settlement and was excavated in 1990. It was shaped like a drawn oval, approximately 5 m in length, 2.5 m wide and 2.2 m deep. On the basis of the geoarchaeological findings, the infilling was divided into 8 sediment complexes. The skeletons of a newborn (0-3 months) and a foetus (9 LM) came to light during the archaeozoological analysis. Their good state of preservation as well as the absence of traces of manipulation indicate that they were intentionally buried at the same time.

In the course of the research program “Approaching the living via the dead: human remains from the Late La Tène site Basel-Gasfabrik and their cultural-historical interpretations” archaeological, anthropological, archaeozoological, archaeobotanical and geoarchaeological analyses were made. The disciplinary data was tested statistically and relevant differences and trends were identified. We were able to show that the infants were deposited in occupation layer material which was infilled quickly. In their direct neighborhood were found statistically significant accumulations of fine ceramics and personal ornaments, animal bones with butchery marks and cereal grains. These observations indicate that the infants were deposited intentionally, possibly accompanied by ritual activities.
An Early Minoan house-tomb at Sissi, Crete: Preliminary soil micromorphology results.

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Sissi is a Bronze Age site located on a coastal hill on the north central coast of Crete. The site is strategically located in the periphery of the important Bronze Age settlement of Malia and at a natural junction of communication lines that connect the latter site to the southern and eastern parts of Crete. Archaeological fieldwork carried out there between 2007 and 2011, included a soil micromorphological study on several contexts, among which the densely built and exclusively funerary area located on the rocky, erosion-prone terraces at the north shore.

Excavations by a joint team of archaeologists and physical anthropologists have found evidence for intensive use of the tombs between the Early Minoan IIA and Middle Minoan IIB (2500-1860 BC) periods. The archaeological remains consist of dozens of coalesced house-tombs, containing multiple interments and exhibiting great heterogeneity in mortuary customs. Micromorphological analysis on samples from one of the funerary structures has revealed a complex, biologically reworked fill microstructure leaving few microstratigraphical clues. However, fragments of mud plaster, lime plaster and laminated clay fragments may be indicative of a lime plaster or render finish.
Soil Micromorphology, phytoliths and Dark Earth. The site of ‘Sint-Jozefscollege’, Aalst (Belgium).

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Soil micromorphology has become an important tool to investigate Dark Earth: thick humus-rich, strongly melanised and apparently homogeneous units, often encountered in the centre of cities, that cannot be understood solely with traditional archaeological approaches.

During the excavations of the site of ‘Sint-Jozefscollege’ in 2009, archaeologists unearthed Dark Earth underneath the remains of the first city wall (11th century AD).

A soil micromorphological study has been performed to understand the processes involved in the formation of the Dark Earth, to identify ancient activities and on a larger scale to contribute to the understanding of the urbanisation of the city of Aalst.

It demonstrates that the Dark Earth has a complex and long formation history, whereby various human activities interact with natural phenomena, such as bioturbation and colluviation.

The oldest phase (5th-6th century) indicates the presence of grassland, possibly used for pasture. Later on the area became cultivated.

The identified activities confirm the rather rural character of the area until the 11th century.
The geoarcheological study of Urban Dark Earth: a state of the art.

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In European urban archaeological contexts, Dark Earth indicates dark-colored, poorly stratified units, often formed over several centuries, frequently rich in anthropogenic remains. More specifically, it is often used to define units situated in between stratified deposits of Antique cities (between the 1st and the 3rd-5th century AD) and medieval ones (from the 11th-12th century AD onwards).

The lack of internal stratigraphy at the macro-scale is a particular problem for urban archaeologists. Therefore, Dark Earth deposits have often been dug away without further study. However, pioneering geoarchaeological investigations (involving soil micromorphology and physico-chemical soil analyses) have successfully been undertaken in UK since the early 1980s. Since then, such studies have also been undertaken in France, Italy and Belgium (since the 1990's). Such investigations first characterise the components of Dark Earth and the effects of post-depositional processes upon them. These analyses have then gone on to prove that in many cases Dark Earth represents a palimpsest of different activities and natural processes, which can still be identified despite Dark Earth being subject to thorough homogenization. Among the identified activities, dumping, agriculture and digging can be cited. The geoarchaeological study of Dark Earths has helped significantly in evaluating the continuity of occupation in post-Antique towns and in understanding their spatial organization.
An Inclination to Deceive: A multidisciplinary approach to detecting buried earthworks fortifications at the Fort Denison site near Humboldt, Saskatchewan, Canada.

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Military texts and homestead-era oral histories document the construction of earthwork fortifications at Fort Denison, which functioned as a provisioning outpost to Dominion Government troops stationed at Batoche (130 km to the northwest) during Canada’s Métis-led North-West Resistance in 1885. The contemporary land surface at the site exhibits no signs of these earthworks, and a key geoarchaeological question is whether the undulating clay-rich layers exposed during archaeological excavations represent trench and embankment fortifications. This question is addressed here using a multi-pronged approach.

First, multiple near-surface geophysical surveys (magnetometry, ground penetrating radar, and resistivity) document several semi-circular and linear anomalies, consistent with historical descriptions of the earthworks’ position and morphology. Second, high-resolution topographic mapping and detailed geoarchaeological analyses (stratigraphy, micromorphology, bulk sediment characterization, and luminescence profiling) indicate that the majority of the clay-rich layers underlying the site constitute naturally deposited relict aeolian dunes. However, a 5.5 metre long anomalous clay deposit recorded during the 2013 field season is interpreted as cultural in origin, likely the infilled fortifications. Our work has wider implications regarding the importance of establishing an understanding of the depositional environment of archaeological sites, particularly when prospecting for buried earthworks.
Soil Micromorphology Analysis of the Chalcolithic fortified settlement of Villavieja (Granada, Spain).

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The Prehistory of Southern Iberia provides a variety of settlements. Specifically, during the V millennium B.P. appear the first fortified enclosures with stone walls, some of them well known. However, the soil use within these unique areas has not not been analyzed so far, and, different claims have been raised on all activities carried out inside these areas. The excavation of a new fortified settlement, Villavieja (Algarinejo, Granada), in an exceptional state of preservation, has allowed applying this new analysis protocol, for the first time for this type of archaeological site in southern Iberia.

The site of Villavieja is located on a high plateau, overlooking the surrounding landscape. Its natural defenses were reinforced, in their side more accessible, by a wall of three hundred meters long. Such fortification encloses the three acres of inhabited grounds. To date, one campaign of excavation has been carried out, whose first results are presented here, concerning the analysis of soils and sediments from the archaeological work area.

The phase excavated hitherto corresponds to the second half of V millennium B.P., the moment when the place was abandoned. The results indicate at this stage a change in weather conditions towards aridity, complemented with the finding of presence of agricultural land inside the fortified enclosure. These crops should be apportioned between the different households inside the village.
Links of Noltland, Orkney: Land management and palaeo-landscape narratives from soil and sedimentary records. Modeling stratigraphic relationships between anthropic sediments using GSI3D.

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At the Links of Noltland, Orkney, buried soils and associated field systems related to Neolithic and Bronze Age settlement survive beneath a dune system now being destroyed by erosion. Such a degree of preservation of both archaeological remains and associated soils is exceptional and so a range of scientific techniques are being applied to establish the formation of the soils and organic deposits in order to understand innovation and changes in field systems management and organization. Over such a large and complex multi-period site, working out stratigraphic relationships between settlement areas and soils/sediments is problematic; here GSI3D, modeling software developed by the British Geological Survey is applied to integrate the results of auger survey and excavation and place thin section micromorphological analysis in context. In doing so, new insights into the relationships between structures, field systems and superimposition of early land management activities is demonstrated.
Pliny and Poo: Analyses of non-metal slag reveals fuel use on Roman-era terp sites in Frisia.

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Pliny the elder described the people in the North of the low countries (the Chauci) as poor wretches that lived on artificial hills (nowadays known as terps or wierden), in a treeless landscape. He describes how the people, lacking wood, used clay as fuel. Many translators assume that Pliny was in fact describing peat. However, many terps and wierden lie far from the peat area, whereas Pliny’s description does not match well with the preparation of peat.

Excavations and micromorphological research on terps and wierden in the last 2 decades have yielded large amounts of non-metal slag, especially in combustion features. Chemical analysis shows that these fragments were most likely formed by the burning of herbivore dung: This fuel contains a silica source (silica phytoliths), as well as means to lower its melting temperature (potassium).

It is likely that what Pliny observed preparation and use of herbivore dung as fuel, and mistook this for clay.
Parasite ova from human graves and other contexts from the InterArchive project.

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Parasite eggs have been identified in human graves, notably well preserved bog bodies and occasionally in the sediments that occur in lead coffins and similar contexts. Grave fills (mostly biologically active soils) have rarely proved to be rich hunting grounds for evidence of parasite ova. The InterArChive project, an ERC funded initiative working is several European countries and brings together a diverse multi-disciplinary team of organic chemists, geochemists, soil micro-morphologists, bioarchaeologists and cultural anthropologists to maximise the information available from human burial from a very wide range of environments.

This poster provides an introduction to the InterArChive project and provides examples of parasite ova from a variety of human burials ranging from well preserved examples to those where many of the more obvious characteristics have decayed. In addition, recent finds of parasite ova in concreted mineralised deposits for sites with calcareous water supplies e.g. 19th century CE slop water closets in York UK and 1st C CE drain pipes Pompeii Italy, will be presented.
Preliminary report on particle-size analysis of the Nakayama site in Akita prefecture, Northern Japan.

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The Nakayama site, situated in northern Japan, is a wetland site with rich archaeological finds such as pottery shards belong to late and final Jomon, stone tools, wooden remains, lacquer wares, and plant remains. In 2012 and 2013, the interdisciplinary research team of Hirosaki University, entitled “the research project for effective utilizations of archaeological remains” have excavated the site to research Kamegaoka culture (final Jomon: ca.3000-230014Cyr.B.P.) and geoarchaeological investigations has been also conducted for providing stratigraphic information as a basis of interdisciplinary approach. We present preliminary results of particle-size analysis of the Nakayama site location B.
Micromorphological properties of Palaeolithic cave sequences in Southern Spain and implications for site formation processes.

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Sediments in caves and rockshelters accumulate by natural and anthropogenic processes, which are often not deducible from macroscopic features or sedimentological and geochemical laboratory analyses. During exploration of two Palaeolithic sites in southern Spain, we took two series of thin sections in order to elucidate site formation processes.

Ardales Cave has a rich record of Palaeolithic cave art, but it is not known, whether the cave deposits contain archaeological find horizons. We opened four profiles within the alluvial cone of the entrance hall and took selected samples for micromorphological investigations. Most of the thin sections display very loosely packed silty loams with dolomite fragments surrounded by silt coatings. These coatings as well as layering and rolled aggregates indicate reworking of sediments, which also affected archaeologically relevant materials such as bone fragments or charcoal. Local strong enrichments with phosphorus are related to bird or bat coprolites.

The sediment sequence of the rockshelter Sima de las Palomas consists of 6 m thick silty deposits with varying admixtures of rocks and boulders, the latter related to partial collapse of the shelter roof. At the base of the sequence, sediment units 9 and 10 with abundant artefacts of Mousterian affinity record strong occupation. Thin sections show dense compaction, high contents of bone, charcoal and silex fragments, few phosphate nodules and very few phosphate infillings. The archaeologically sterile unit 7 still contains microscopically visible bone and charcoal, but no silex. Also, it is more loosely packed than the occupation layers. However, a low degree of compaction is also evident for units 6 to 4, all containing scattered Mousterian lithics, charcoal, bone and mollusc shells. As based on micromorphological properties and sediment burial dating using the luminescence method, these units could represent reworked sediments.

The contribution will present the microscopic features of the cave and rockshelter deposits and discuss their relevance for elucidating site formation processes.
Medieval horse husbandry; case studies based on micromorphological approach.

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The research of Medieval horse husbandry doesn’t have a long tradition and all the information available are rather fragmentary. During last few seasons we got a possibility to work on two different case studies connected with horse husbandry. One is horse stable in Veseli nad Moravou (Czech Republic) dated to 14th Century, while the second one is the blacksmith workshop from Brno-Modřice (Czech Republic), dated to 11th Century.

The studied stable had two construction phases with well preserved infilling, which composition reflects maintenance practices. It is evident that the infilling originated anthropogenically as a way of remediation. The erosion is given due to the sandy erodible background and the fact that during the removal of stabling the background is repeatedly removed because of sticking on the stabling. Due to such maintenance practices were preserved minimally 10 aggradation layers composed of waste from ovens and also common domestic waste as visible from the appearance of animal bones which were not burnt. On the other hand such waste has remediation effect and protects against the inflammation of hoofs. The uppermost part of the stable infilling is composed by the well preserved stable with a number of horse hairs and findings documenting the horse husbandry.

In the case of blacksmith workshop there were identified floor layers resulting from the trampling as well as thin layers interpreted as a result of remediation. Those layers are composed of phosphates and spherulites coming from animal excrements. It is evident, that this material was supposed to have remediation effect. Another interesting part of the floor layers are small spherulites coming from the process of ironwork. It documents the methodological level of the ironwork in 11th Century.
Neolithic Combustion at Cueva del Toro (Málaga, Antequera, Spain): A Microstratigraphic Approach.

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Here we present a microstratigraphic investigation of sediment samples from the main combustion zone of the Neolithic occupations from Cueva del Toro (Antequera, Málaga, Spain). This site has yielded a rich Early to Middle Neolithic archaeological assemblage associated with handcraft activity and zooarchaeological evidence of sheep and goat penning, suggesting that the shepherds and their domestic animals shared the same living space. The goal of our investigation is to clarify the function of the combustion zone, which showed a layer cake structure in the field. Previous excavation provided stratigraphically associated carbonized cereal and leguminous seeds and ovicaprine coprolites, leading to ambiguity regarding the function of each of these elements as well as the combustion activity. Our results show that the white, black and brown layers of the combustion zone represent dung derived sediment and apatite crust presence. Crucially, the brown layers were identified as “migon”, or trampled stable floor material, testifying to the function of this zone of the cave as pens for sheep and goat. This study corroborates that the occupants of Cueva del Toro were shepherds, sheds light on the organization of the living space within the cave and also documents the practice of cohabitation of shepherds and their animals in the Neolithic.
Micromorphological approach to a 2nd century Gallo-Roman place of worship at Kempraten (Central Switzerland).

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During excavations in 2009/10 at the periphery of the Roman vicus Kempraten (Rapperswil-Jona, SG), situated on the eastern shore of Lake Zurich, a Gallo-Roman sanctuary with two Romano-Celtic temples was unearthed. According to current knowledge the sanctuary was built around 100 AD and was in use until the 4th Century. The walled-in area, measuring 900m² was divided in two parts: The Romano-Celtic temples, with their central room surrounded by an ambulatory, dominated the northern part of the site; the southern part was kept free for a sacred grove. The Altar for burning offerings was situated between both buildings in the central area. Prior to the construction of the stone buildings, the temple had originally been built of wood. A wide spectrum of finds, such as huge numbers of pottery, clay figurines, coins, small votive axes and four lead tablets with antique curses and spells, give insight into local cultic practices. The temple most likely was dedicated to the mother goddess Magna Mater (Cybele).

Soil samples from the temple area where collected for an interdisciplinary study which included archaeobotany, archaeozoology and geoarchaeology, in order to gain more information on the rituals and cult activities in Roman times. Three micromorphological soil samples are presented: one from the periperal galleries of temple B showing sequences of gravel fills, constructed loam floors and occupation layers. Two more samples come from the area of the altar and the sacrificial burning area, showing the accumulation sequences of a ritual place.
Shell middens in Tierra del Fuego, Southern South America. A micromorphological study of hunter-gatherer contexts.

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The North of Isla Grande del Tierra del Fuego, Southern South America, has been occupied since the Early Holocene by hunter-gatherer groups focused on the exploitation of guanaco, other small mammals, birds, and marine resources. The Marazzi Site 2 is an important coastal archaeological site of this area, located in a cold and semi-arid environment. This site presents evidence of redundant occupations of terrestrial hunters who left shell middens and some dispersed but stratified materials such as stone artifacts, bone remains and pigments. The lower layers of the shell midden yielded two dates: 1816-1902 cal BC and 2755-2800 cal BC. With the aim of evaluating stratigraphy, discontinuities and formation process of that deposit, we will discuss the results of micromorphological sampling along the shell midden profile. Results suggest massive deposits and some post-depositional processes which do not allow us to distinguish different components or hiatus.
Radiocarbon dates and the oceanic fluctuations in TrangAn site (NinhBinh, Vietnam).

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TrangAn locates in the maritime wetland in the north of Vietnam, and is a geo-archaeological heritage. In the region, there are a lot of the traces of sea which the imprinted on limestone walls. By evaluation the datation and the height of the ancient marine traces, we determined the regional oceanic fluctuations.

In the paper, there were about 30 objects (both of geological and archaeological samples) were dated. The radiocarbon method, that consists of benzene synthesied technique and liquid scintillation analyzer (Tri-carb2770 TR/SL) were performed.

The obtained results shown that TrangAn area is advantageous environment for residence by prehistoric man for long time. Beginning around 20 000 years ago, there was ancient man living in limestone caves, they exploited freshwater mollusks, snails, collected vegetables and roots and caught small mammals. In the middle Holocene, the regional sea level increased and reached the maxium degree at with 4.5m higher than current, and prehistoric inhabitants moved to live on the soil moutain sides.
The vitrified Bronze Age fortification of Bernstorf (Bavaria, Germany) – an integrated geoarchaeological approach.

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“Vitrified forts” are phenomena which appear throughout Europe during prehistoric times. The vitrified Bronze Age fortification of Bernstorf is one of the largest north of the Alps. The possible importance of the Bernstorf site is exemplified by gold and amber finding, which may imply that it was part of an important trading route connecting the Baltic Sea with the Mediterranean. The burned wall is an invaluable example for studying burning temperatures, because it displays a temperature zoning with various heating features. This zoning of structurally altered sediments are recognizable in thin section and suitable for the development of micromorphological criteria to identify burning processes such as reddening, vitrification and melting. Information which can be used to reconstruct past human fire activities. We base and reassure our results on semiquantitative mineral analytical methods namely XRD, EDS and magnetic susceptibility. Moreover, we compare our results with those of Kresten (1998) and Gebhard et al. (2004), whose samples stem from a different part of the wall. Based on all these data we get a broader picture of the burning conditions and are able to relate micromorphological burning features to temperature regimes.
Soil micromorphology of sediments at Torgårdsletta, Tiller, Trondheim municipality, Norway.

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Torgårdsletta in Tiller, Trondheim municipality, western Norway, is a moraine area, ca. 200 m a.s.l., with archaeological traces from human settlements back to Bronze Age and until Early Medieval times. The poster presents the micromorphology within investigations carried out by Geir Grønnesby and the Museum of Natural History and Archaeology (NTNU) in 2010/12, focusing on a thick ancient cultural layer, revealed in the subareas Torgård and Kvennild. Two profiles were analysed. They were strongly impacted by human activity. Although the interpretation of the thin sections was complicated, it was possible to distinguish eight phases with human activity in profile 2, and six phases in profile 1, where the stratigraphy was rather disturbed. From around 830-805 BC (Late Bronze Age), the locality was presumably used for pasturing and building activities, while cereal cultivation may have started in the vicinity. After some periods, characterized by changes in the use of the locality, people seem to have transferred layered organic materials to the locality around AD 615-655 (Late Iron Age). First from around AD 895-985, there are distinct traces from a longer cultivation period, followed by a more recent phase with traces from various human activities.

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Recent studies on the identification of activity areas in archaeological sites through geochemical and phytolith analysis of soil samples demonstrate the value of such techniques, but at the same time acknowledge the need for a better understanding of the taphonomic processes that are involved in the creation of such soil signatures. This poster will introduce a new project that aims to contribute to current knowledge of these taphonomic processes and maximize the information gained from Neolithic settlements.

Ethnographic soil samples collected from Bedouin camp sites in Wadi Faynan, Jordan, will be analysed in order to correlate their anthropogenic signature to observations made at the sites during fieldwork. The samples were collected from various localities that were occupied for different durations of time, therefore allowing for the formation and altering through time of the geochemical and phytolith assemblages to be addressed. The combined method will then be applied to soil samples taken from Neolithic sites in Azraq and Wadi el-Jilat, Jordan, in order to assess the method’s efficacy and contribute to our understanding of daily life during the Neolithic.
Micromorphology as a tool for early medieval town research.

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Micromorphology, a method that studies undisturbed soils and sediments under the microscope, has proven a useful tool for the study of archaeological sites. In particular, this geoarchaeological method is suitable for tackling a number of issues that are recurrent in the research of early medieval towns and are often difficult to study with other methods. A selection of the themes that micromorphology has contributed to is explored in this poster, illustrated with examples from Kaupang (Norway) and Antwerp (Belgium).

Micromorphology has the potential to contribute to many issues in the research of towns from the early medieval period, including site formation processes, composition and organisation of the original soils and sediments, human activities, size and organisation of buildings, environment and sea level, post-depositional processes, etcetera. This method is particularly suited to this kind of research as it can be used to explore questions and supply information on both micro (single events) and macro (environment and formation processes) scale, despite the fact that the town contexts in question are often severely disturbed by post-depositional processes.
Notes
Notes
The Swiss society for Quaternary research (CH-QUAT) is open for all interested persons or organizations.

Founded in 2007, the society aims at establishment of an interdisciplinary scientific network in Switzerland. Together with the Swiss Academy of Sciences (SCNAT) our goal is to encourage and support dialog between those involved in Academia and those involved in applied aspects of Quaternary research.

CH-QUAT is envisioned as the point of overlap between scientists from different areas of research and application involved in study of the Ice Ages (Quaternary) and especially aspects of Man - Environment - Climate. Collaboration between archaeologists and environmental scientists has proven to be a highly valuable and rewarding research path for all partners.

Moreover, we encourage interaction between other topic-specific organizations. Finally, a key goal of CH-QUAT is promoting the advancement of young scientists and interaction with experienced scientists.

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