Reading the soil in archaeology: field practice and interdisciplinary perspectives

International symposium
Tours (France)
29.11.2023 - 01.12.2023

Book of abstracts

https : //archeosol2023.sciencesconf.org/

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OFFICE DU PATRIMOINE ET DE L'ARCHÉOLOGIE
SECTION ARCHÉOLOGIE

Illustrations

1 - Stratigraphy of the successive layers of occupation and heightening of the medieval mound of Ecoust-Saint-Mein (resp. Thierry Marcy, Inrap Pas-de-Calais). © Kai Fechner, Inrap

2 - Bottom of a large ditch with various traces and shells favouring the interpretation of a probable ancient canal (Waremme “Costale”, resp. Dominique Bosquet, APW). © Kai Fechner, Inrap

3 - Archaeology: a question of viewpoints. Archaeological research requires the collaboration of professionals from different disciplines, starting with fieldwork. Kruibeke-Bazel (Belgium). © Pierre Buch (from the exhibition “Profession Archéologue”, ACE project)

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5 - Remains of occupations dating from the Neolithic and Middle Bronze Age, interspersed with deposits testifying to multiple lacustrine transgressions alternating with phases of soil formation (Colombier/Les Plantées de Rive 2013, Neuchâtel, Switzerland). © Laténium

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KEYNOTE LECTURES

Basic's about field prospection in soil (earth) science for archaeology and history

Roger Langohr

Earth science has mainly 3 components: geology (stricto sensu), geomorphology (physical), soil science or pedology. The collaboration with archaeology: "geoarchaeology" is often mentioned but what about "archaeogeology" and "archaeopedology"?

Here I will focus mainly to archaeopedology. Soil science can indeed contribute considerably to archaeological research.

But the feedback is in two directions: never soil science progressed so much as since the collaboration with archaeology, particularly concerning knowledge about the four dimensions of the soilscape, the soil variability and soil genesis, including the time factor. This contributes to the status of "happy" soil scientist.

Soil science has many applications: crop growth with aspects of tillage, drainage/irrigation, fertilisation; plant ecology, for wetlands, forests, grasslands; land management etc. But here we focus mainly on palaeoenvironment reconstruction with the purpose of "story telling". This discipline receives little attention in most soil handbooks.

About Palaeoenvironment reconstruction, a set of basic concepts is essential.

- Soils do have a nearly infinite number of morphological, physical, chemical, biological characteristics. Most of these characteristics are the result of pedogenetic soil processes such as water percolation, freeze/thaw, mineral weathering, migration of soluble substances and particles, etc.
- All these processes are tributary of internal and external environmental factors ("factors of soil genesis"). Eleven factors are important here (figure 1).
- The final objective in archaeopedology is to establish the link of these processes to the environment before, during and after the occupation period. In some case studies this can contribute to understanding of human behaviour.

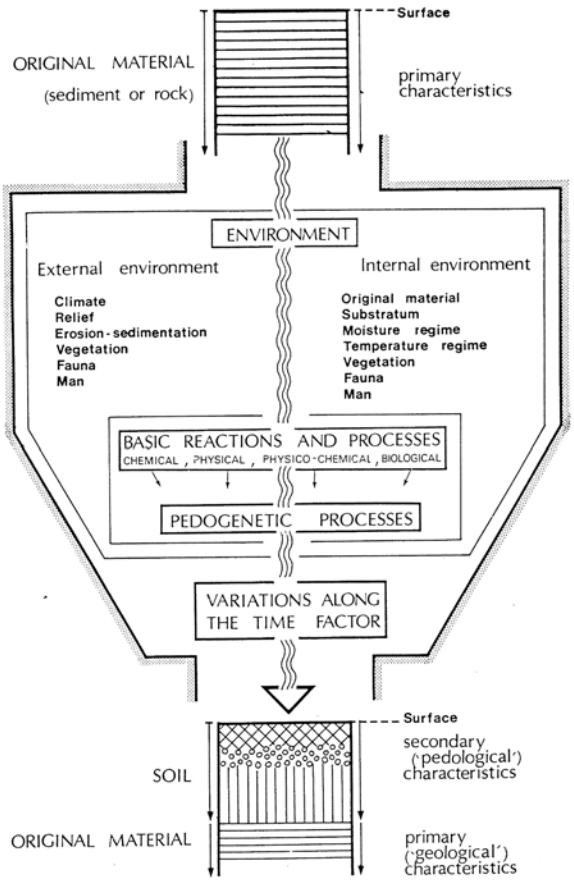
In the field, some topics are important in this type of research.

- First of all, one should collect the questions raised by the archaeologists
- The search of the "reference profile" or the soil profile as close as possible to the soil type present at the moment of site occupation.
- The supreme qualification: playing with the presence/absence of soil characteristics.
- Elaborate an earth science check list adapted as good as possible to the site under study.
- Include a confidence level of the interpretations.
- Frequently it is most important to dig deeper and larger than the archaeological structure. This allows to detect important soil characteristics associated to the structure (the "associated soil characteristics").
- Finalise with a reliable "story telling".

The information quality of soil maps, if they exist, should be checked. When useful, a translation key between soil map legend and archaeology must be established. For example, the soils of whole Belgium have been mapped on the basis of auger observations, 120 cm deep and at a distance of 75 m (some 3 million observations) in addition of several thousands of excavated soil profiles. A set of legend units are closely related to archaeological and historical events.

To illustrate the above items, the presentation will discuss the results of a set of research sites in archaeopedology.

Keywords: archaeopedology, palaeoenvironment reconstruction.



Towards an archaeology free of furniture. Object, context and environment: reversed priorities (1990-2020)

Jan Vanmoerkerke

Since the late 1980s, archaeology, particularly preventive archaeology, has been slowly integrating paleo-environmental approaches, particularly soil science. Contrary to what is sometimes said, this is not simply a question of adding new disciplines, but of making fundamental changes to the way archaeology works. The central role of artefacts, an old legacy of antiquarianism of which there are still traces whatever people say, is gradually being replaced by the context, and then very recently and tentatively by the environment.

The aim of this introductory paper to the symposium is therefore to show how archaeology, in all its aspects, has been constantly redefined, with changing priorities, and how the evolution of the environment, at first absent and then ancillary, is becoming the central subject in which contexts are placed, possibly with furniture. These successive changes have never been a smooth ride, on the contrary, and it is important that specialists in the palaeoenvironment, and in particular readers of the soil, understand that it is not simply a question of getting a slice of the cake (of preventive archaeology) but of becoming players who are aware of these fundamental changes that are transforming archaeology and which, alone, justify this integration.

I would also like to emphasise the role of absolute dating, which, in addition to the help that this principle can give to palaeo-environmental approaches, plays an essential role in the fundamental changes mentioned above, in particular by helping archaeology to move away from furniture and refocus on the context and the environment.

Nor can we ignore an old debate that we thought had been settled too quickly. The notions of site, and then of occupation, are still used in a very restrictive way, as they were in the days of "stations" and "date-taking"; the realisation that our studies concern all spaces, outside or within the site, all equally interesting, remains incomplete. Here too, archaeology needs to adapt, at the same time as changing its conceptions and definitions and integrating environmental approaches.

I will end my presentation with some more concrete considerations on very recent developments in the integration of palaeo-environmental approaches, followed by the conservation/selection of samples.

[Translated with www.DeepL.com/Translator]

Keywords: preventive archaeology, paleoenvironment, absolute dating, archaeological site, settlement.

- 1 -
HIGHLIGHTING GEOARCHAEOLOGY AND ITS POTENTIALS

Crossroads between archaeology and earth sciences: an example of application in the canton of Neuchâtel (Switzerland)

Sonia Wüthrich, Judit Deák

The canton of Neuchâtel was one of the forerunners in the development of preventive archaeology in Switzerland, initiated in the 1990s as part of major linear works - construction of the A5 motorway on the north shore of Lake Neuchâtel. The approach adopted at the time was not only to systematically carry out diagnostic surveys prior to civil engineering works, but also to apply an interdisciplinary approach, bringing together archaeologists and earth scientists. A major challenge for a winning investment! The research carried out essentially concerned terrestrial environments, with soils and sedimentary deposits as well as archaeological evidence, most often heavily altered by anthropic - agricultural - activities over time. In such a context, close collaboration and ongoing dialogue between the various players proved necessary and fundamental to the intrinsic understanding of the deposits, and more broadly, the reconstruction of their environment and contemporary landscapes.

Although these exceptional major works have now been completed, the pressure on the heritage of development and construction projects continues, at an ever-increasing pace, while the resources available are not always sufficient. In light of this paradigm shift in preventive archaeology, and building on the achievements of past projects, the Archaeology Section of the Office du patrimoine et de l'archéologie du canton de Neuchâtel has decided to pursue this interdisciplinary approach, albeit with a more targeted approach to questions and a data documentation and recording strategy tailored to the different sedimentary and intervention contexts encountered. Using a few examples in particular, this presentation will discuss the issues, strategies and results of the interdisciplinary approach as practised in Neuchâtel.

[Translated with www.DeepL.com/Translator]

Keywords: preventive archaeology, interdisciplinary approach, archaeology and earth sciences.

Illustration

Archaeological survey on the Bevaix plateau (Neuchâtel, Switzerland).

Credit: Laténium

Geo-pedology at the service of preventive archaeology in Wallonia. Between science and technology

Olivier Collette

Geo-pedology applied to archaeology helps us to understand the traces of the past and opens up new avenues of investigation. In the context of preventive operations, the conditions of intervention place this contribution in a special situation, between methodological application and scientific research. This is the case for the geo-pedological work carried out by the Walloon Public Service for the Walloon Heritage Agency.

In preventive archaeology, the soil sciences are called upon to provide rapid, precise and comprehensible answers to questions that are often crucial to the implementation of interventions. The urgency of the situation, the diversity of contexts and the limited resources available require the use of tools and know-how that can be implemented rapidly. This field of knowledge is not sufficient on its own in this context; it only provides an element of understanding within a whole that is mainly accessible through a global archaeological vision.

The answers given at the time of diagnostic, during excavations or when disseminating results should ideally involve a complete and appropriate scientific approach. This is not always possible due to lack of time, resources, specific knowledge and updates. In the end, it is basic knowledge and the use of experience that prevail and provide profitable support. In this position, the geo-pedologist providing support for preventive archaeology projects cannot be considered a specialist. Rather, they are generalists who carry out a series of specific technical operations. Like archaeologists, they do not know in advance the nature of the remains they will encounter. Neither experimentation, repetition nor confrontation, which are part of the scientific approach, have any place in the preventive approach. The data to be processed emerges as and when discoveries are made and the study protocols are structured in a rather empirical way.

The "preventive" geo-pedologist, on the other hand, benefits from a wide variety of situations and contexts. This gives them access to invaluable resources for understanding. Although they are fortunate enough to acquire a relatively broad range of experience, they do not always have the opportunity to put it to good use in thematic research. It's at this stage that they can become a real bridge-builder.

In Wallonia, although the centres devoted to the earth sciences are recognised and active in many fields, few of them focus their research on archaeology. One of the tasks of the "preventive" geo-pedologist is to stimulate collaboration with research centres, but this often takes second place in his or her agenda. However, the benefits of this work are twofold: it brings new opportunities to the research centres and refines our understanding of the phenomena encountered in archaeology. Maintaining a dynamic link should therefore be considered essential.

In preventive archaeology, it is more a question of reading the soil than studying it. This reading is done with a basic vocabulary that is as complete as possible, understandable and usable for the archaeologist. It is still desirable to develop and refine this vocabulary to better describe and transmit useful information. That's what makes this operation so special, somewhere between science and technology.

[Translated with www.DeepL.com/Translator]

Keywords: preventive archaeology, scientific approach, methodological application, technical operations, research centres, transfer of experience.

Illustration

Reading soil in preventive archaeology: between science and technology.

Credit: Olivier Colette.

Soils and Archaeological sediments in long term investigations on archaeological sites. The example of the excavation at the Terramara Santa Rosa di Poviglio (N Italy)

Mauro Cremaschi, Andrea Zerboni, Michele Degli Esposti, Federico Borgi, Stefano Costanzo, Luca Forti

Excavations at the Terramara of Santa Rosa di Poviglio (Middle and Late Bronze Age), in the Po Plain of Northern Italy, have been ongoing since 1984 with a tight synergy of archaeologists, geoarchaeologists and bioarchaeologists. Pedological and sedimentological characterizations of the archaeological contexts are executed on field as well as in post-excavation laboratory procedures, with routine employment of radiocarbon dating and extensive use of thin section soil micromorphology.

In 40 years of excavations, two out of the seven hectares composing the Terramara were investigated, unveiling various functional areas and features such as living districts with buildings, settlement perimeter with embankments, stockades and fences, bridged moats, and other hydric infrastructures. For each feature, geoarchaeological analyses defined the formation process. Results, supported by further archaeological and bioarchaeological insights, highlighted different phases and transient conditions of the Terramara in respect to cultural dynamics and climate change. The produced information covers the entire chronology of the Terramara until its last occupation phases, which are coeval with the societal crisis that caused the disappearance of the entire Terramara Culture. Moreover, analyses revealed post-abandonment taphonomy connected with the swamping of the area that happened in Medieval and subrecent times.

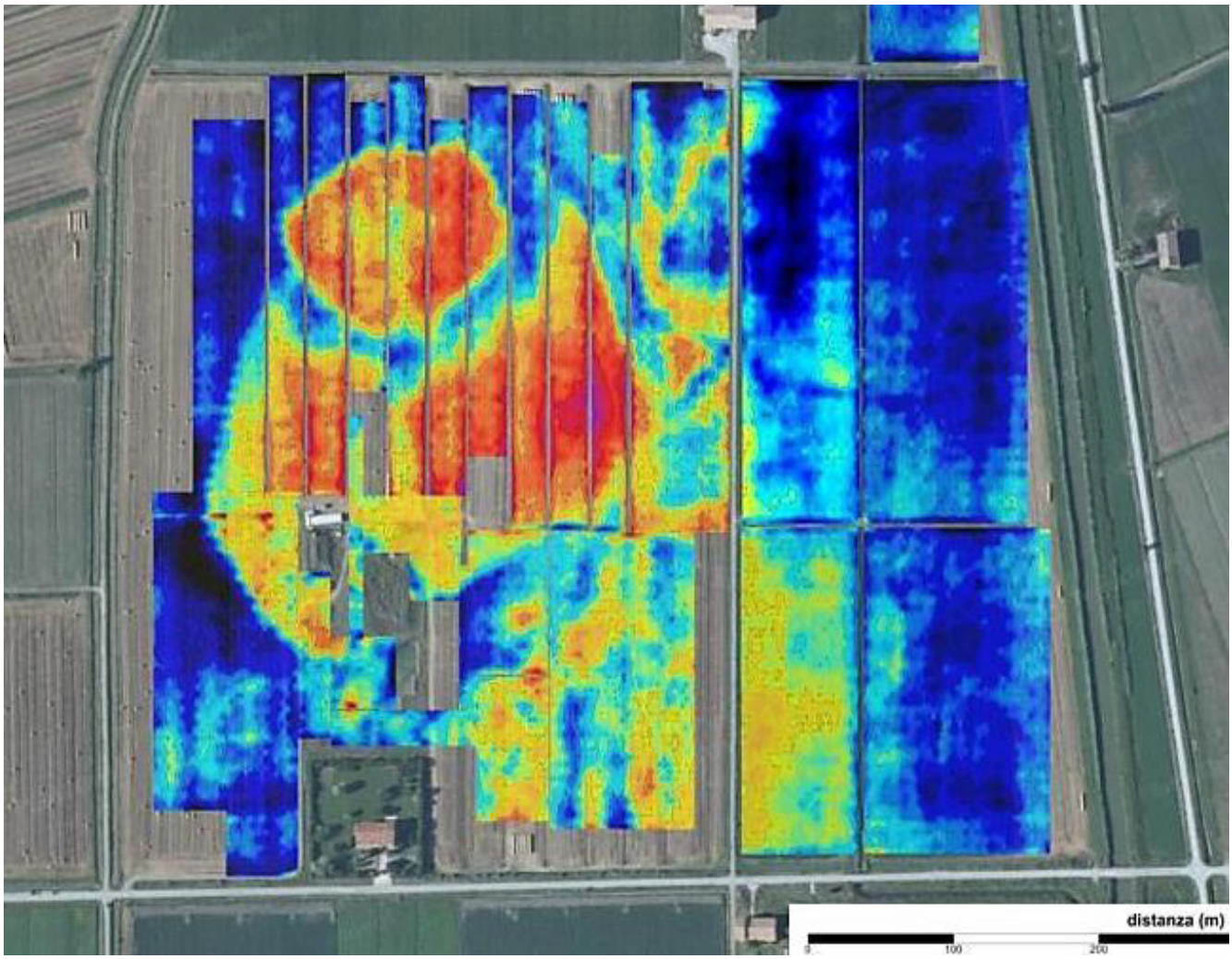
The synergic excavations at Santa Rosa di Poviglio were among the first of their kind. The successful cooperation of professionals coming from different backgrounds is a model that has been catching on ubiquitously over time, and the routines and standards set by the activities at Santa Rosa di Poviglio constitute good reference for the feasibility of the composite approach and deserve to be pushed even further across more archaeological endeavours.

Keywords: Po plain, Middle Bronze Age, Terramara Santa Rosa, Geoarchaeology, forming processes, water manegment, ditches, wells.

Illustration

Geophysical survey of the Terramara Santa Rosa site.

According to: Mele M., Cremaschi M., Giudici M., Lozej A., Pizzi C.,Bassi A. (2013). The Terramare and the surrounding hydraulic structures : ageophysical survey of the Santa Rosa site at Poviglio (Bronze Age, northern Italy). *Journal of Archaeological Science*, *40*, 4648 – 4662.



How are we building the tools for a history of Norman soil and landscape?

Philippe Fajon, Caroline Riche, Cyril Marcigny, Sylvain Mazet, Bruno Aubry

Over the last 30 years, the Normandy side of the Seine Valley has been the setting for a number of experiments involving the reading of the rhythm of human settlements, their spatialisation, their integration and their impact on the environment, from the Palaeolithic to the present day.

Little by little over the years, the tools of life and earth sciences and geography have been integrated. This has enabled regional research to evolve towards the reconstruction of ancient environments.

Initially confined to one-off projects, this research dynamic was able to broaden its investigations and methods following the 2001 law and developments in preventive archaeology. The exploitation of sand and gravel by quarries located in alluvial areas, the real sedimentary memory of the valley, very quickly constituted a privileged and promising ‘playground’, both for the analysis protocols to be put in place and for the way in which the prescribing service constructed the scientific specifications.

By gradually extending the project to other geographical areas in Normandy and other types of land development, the very notion of an «archaeological site» and the space to be taken into account evolved in the minds of archaeologists. This has facilitated a broadening of the notion of "heritage to be conserved through study" to include soil in its structure, its form, its use by human societies and its evolution.

[Translated with www.DeepL.com/Translator]

Keywords: preventive archaeology, retrospective, environmental archaeology, integrated approach, Seine valley, landscape.

- 2 -
FIELD RECORDING:
TERMINOLOGY AND PROTOCOLS

Around the notion of stratigraphic unit: towards an effective formalisation of the stratigraphic record, taking into account the practice of excavators and the contributions of the earth sciences

Bruno Desachy

Stratigraphic observation protocols in field archaeology have their main origins in the work of the first prehistorians of the 19th century, who were both naturalists and geologists, benefiting from the concepts and methods of the then recently formed geology.

Following this first legacy of geology to archaeology, the stratigraphic approach of archaeologists, and more generally their concepts of describing and analysing the terrain (i.e. the context of the elements observed and collected during excavations) evolved in a way that diverged from the earth sciences, due to the specific nature of the anthropic processes (and no longer just natural dynamics) at work. This divergence is marked, for example, by the notion of «occupation soil», a specifically archaeological field analysis concept for studying the traces of the activities of the societies studied, developed (by A. Leroi-Gourhan) in the 1950s, in a break with the vertical stratigraphic vision inherited from classical geology; or even more so by the reformulation of the concepts of archaeological stratigraphy in the 1970s (by E. Harris).

This evolution in archaeologists concepts has not only been divergent, but also progressive: Unlike the terminology of the earth sciences, whose evolution is more regulated and unified, the descriptive vocabularies of the terrain in archaeology are diverse, reflecting different types of terrain and different research traditions, and are not always fully explicit and defined; whereas their intellectual importance is fundamental because they translate the basic information necessary for the construction of the archaeologist's discourse, from the processes of formation of anthropic traces, to the event, cultural and social interpretation of these processes, and to the temporalities that they reflect.

This situation of diversity and blurred definitions is not a bad thing, as it reflects a wealth of experience and empirical know-how that it would be a shame to ignore; but it can make communication complicated, not only between excavators, but also between excavators and geo-archaeologists. And yet, over the last thirty years or so, the development of geoarchaeology has, in a way, materialised the reunion of the earth sciences and field archaeology.

This paper will look at the challenge of clarifying the concepts of field analysis used by excavators, linked to the challenge of linking these concepts more effectively with those of geoarchaeology and its various components (micromorphology, archaeoepedology, etc.). It will do so from the more specific point of view of research that is in the process of formalising the processing of stratigraphic data, based on a re-reading of the concepts - which are explicit and defined - of E Harris.

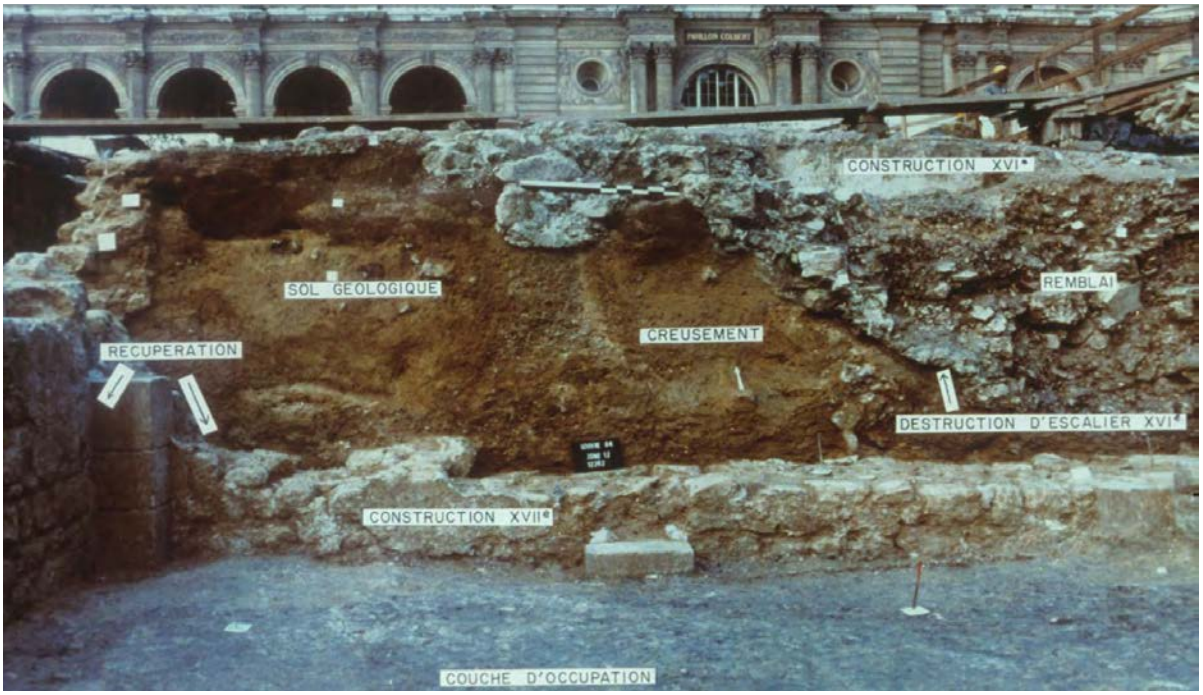
[Translated with www.DeepL.com/Translator]

Keywords: archaeological stratigraphy, formalisation, field recording.

Illustration

Interpreted archaeological stratification (remains of modern cellars). Archaeological excavations in the Cour Napoléon of the Louvre (Paris), 1985.

Credit: document AFAN, CRDP.



Defining archaeological contexts in geoarchaeological field practice

Diego E. Angelucci

Current archaeological field practice is standardised in many countries. In most cases, the identification of contexts (aka excavation units, units of stratification) relies on standard concepts of archaeological stratigraphy outlined by E. Harris (1979; 1989), Ph. Barker (1977) and others. Over time, this standardisation has given rise to customary norms (such as the "single context recording system" in the UK, see MOLAS 1994) or even mandatory regulations (as in Italy, see Parise Baldoni & Ruggeri Giove 1984). By proposing guidelines and practical rules, this system has helped archaeologists to improve proper excavation, field identification of the units and their recording.

Despite their importance and effectiveness, the contexts defined by routine stratigraphic practice are not always adequate to contend with the different situations and variety of cases that archaeological stratifications may show. For instance, open-air sites that have been subjected to soil formation (in particular prehistoric ones) often embed archaeological remains within soil profiles and horizons whose organisation does not obey the stratigraphic law of superposition. The same happens for archaeological surfaces that have been exposed for a long time and thus turned into archaeological palimpsests. Another peculiar case is that caused by thick homogeneous layers which can camouflage former bedding as a result of bioturbation or slope dynamics such as soil creep. Eventually, situations in which accumulation and modification dynamics act almost simultaneously may lead to stratigraphic paradoxes (an example being fumier deposits; see Angelucci *et al*., 2009).

For these reasons and for the sake of understanding formation processes and correctly excavating sites, the geoarchaeologist sometimes needs to go beyond routine archaeological stratigraphy and use specific entities for the identification of the field units. This can be done by combining distinct concepts from archaeology (contexts / excavation units), sedimentology (layers), soil science (horizons and profiles) and Quaternary stratigraphy (UBSU – unconformity bounded stratigraphic units).

In recent years a new kind of operational tool, the GFU (geoarchaeological field unit; Angelucci, 2002), has been tested in the field. Some examples of the application of the GFU are provided here, and its use as a tool for the geoarchaeological study of archaeological deposits in the field is proposed.

Keywords: archaeological stratigraphy, geoarchaeological fieldwork, field description, geoarchaeological field unit

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Bibliography

- Angelucci, D.E. (2002). The Geoarcheological Context. In J. Zilhão & E. Trinkaus (eds.), *Portrait of the Artist as a Child. The Gravettian Human Skeleton from the Abrigo do Lagar Velho* (p. 58–91). IPA, Lisbon.
- Angelucci, D.E., Boschian, G., Fontanals, M., Pedrotti, A. & Vergès, J.M. (2009). Shepherds and karst : The use of caves and rock-shelters in the Mediterranean region during the Neolithic. *World Archaeology*, *41 (2)*, 191–214.
- Barker, Ph. (1977). *Techniques of Archaeological Excavations.* London : BT Batsford.
- Harris, E.C. (1979). *Principles of Archaeological Stratigraphy.* London : Academic Press.
- Harris, E.C. (1989). *Principles of Archaeological Stratigraphy (2nd ed.).* New York : Academic Press.
- Museum of London Archaeology Service - MOLAS. (1994). *Archaeological Site Manual (3rd ed.).* London : Museum of London.
- Parise Baldoni, F. & Ruggeri Giove, M. (1984). *Norme per la redazione della scheda di saggio stratigrafico.* Roma : Istituto Centrale per il Catalogo e la Documentazione.

The tools of archaeological taphonomy: the key to the soil?

Mathieu Rué

A study of the formation of the sites is a prerequisite for the archaeological exploitation of the material evidence collected. In many cases, these remains are contained within stratigraphic units with no natural or anthropogenic diagnostic features or internal discontinuities, making it difficult to study how the remains were laid down. In this type of frequent context, the tools of archaeological taphonomy, such as the spatial analysis of the distribution of the remains, the analysis of the factories, the study of the granulometric distribution of the objects or their surface conditions, are a useful complement to the classic stratigraphic approach, providing a more objective estimate of how the sites and associated soil horizons were formed. However, despite their origins partly in the geosciences and their existence for several decades, these tools are still under-used by geoarchaeologists. This can be explained by the time it takes to apply or master these tools, the collective effort required to synthesise the results, the lack of appropriate training and the complexity of the archaeological record we face. The aim of this presentation is to illustrate the benefits and limitations of using taphonomic tools, taking the example of several pre- and protohistoric open-air sites embedded in silty deposits, particularly when reading the soil is not very informative. In the future, the development of *in vivo* experiments for taphonomic purposes would help to consolidate existing references and thus contribute to a better estimate of the degree of preservation of the areas occupied.

[Translated with www.DeepL.com/Translator]

Keywords: intra-site geoarchaeology, soil and sediment context, archaeological taphonomy, state of conservation, experimentation.

Illustration

Understanding the evolution of soil and sites through experimentation: measuring factories in a flintknapping workshop.

Credit: Mathieu Rué.

Soil science in archaeological (field) research in Flanders: introducing a new descriptive field handbook for soil description and classification. Present framework and future challenges.

Jari Hinsch Mikkelsen, Carole Ampe, Nathalie Cools, Yannick Devos, Stefaan Dondeyne, Katrien Oorts, Marnix Pieters, Roger Langohr

Back in the seventies, soil scientists sporadically joined field archaeologists during excavations. More importantly, they participated in the discussions, interpretations and conclusions that often led to important pioneer publications of interdisciplinary studies and field methodologies.

Under the impulse of the Valetta (Malta) convention from 1992, ratified in Flanders and Belgium by 2010 and enforced from 2011 on, archaeological research finally found a legal framework.

By 2016, the Flemish Government introduced the "Code of Good Practice" (CGP): an extended document that describes in great detail how archaeological research should be conducted from the first assessment to the final report. New to this CGP was the systematic integration of natural sciences and in particular soil science.

In 2020 a steering committee of experienced field soil scientists and archaeologists joined forces under the auspices of the Heritage Agency of the Flemish Government with the purpose to produce field guidelines for soil research in archaeology.

The new guidelines (2023) are adapted to regional types of soils, geomorphology and geology. They are linked with the existing Database of the Subsoil in Flanders (DOV) and the very detailed soil mapping of Belgium. New are the extended integration of manmade soils and materials and how to report on different types of anthropogenic soil impact. The new guidelines fill up a long existing vacuum, and form an important step towards a more systematic gathering of soil data.

Keywords: soil guideline, field archaeology, Valetta Convention.

Bibliography

- Ameryckx, J.B., Verheye, W., Vermeire, R. (1995). *Bodemkunde : bodemvorming ; bodemeigenschappen ; de bodems van België ; bodembehoud en degradatie ; bodembeleid en bodempolitiek.* Gent : Wettelijk Depot : D/1995/Willy Ameryckx, uitgevers.
- Databank Ondergrond Vlaanderen. *Digitale bodemkaart van het Vlaams Gewest.* https : //www.dov.vlaanderen.be.
- FAO. (2006). *Guidelines for soil description (4th edition).* Rome : Food and Agriculture Organization of the United Nations.
- Mikkelsen, J., Ampe, C., Cools, N., Devos, Y., Dondeyne, S., Oorts, K., Pieters, M. & Langohr, R. (2023). *Veldhandleiding voor het beschrijven van bodems bij archeologisch onderzoek in Vlaanderen.* Brussel : Handleiding agentschap Onroerend Erfgoed 29. 80 p. https : //doi.org/10.55465/TJAE3292.
- Petit, S. & Heyninck, C. (2019). *Formation pédologie ANF. Dossier de terrain. Forêt Nature.* Le Gouvernement Du Grand Duché de Luxembourg. 25p.
- Van Ranst, E. & Sys, C. (2000). *Eenduidige legende voor de digitale bodemkaart van Vlaanderen (Schaal 1 : 0000).* Gent : Laboratorium voor Bodemkunde. https : //www.milieuinfo.be/dms/d/d/workspace/SpacesStore/417aadac-822a-4401-965e-ea9a4119f0a6/eenduidige%20legende_bodemkaart.pdf.

Illustration

Manual cover of "Veldhandleiding voor het beschrijven van bodems bij archeologisch onderzoek in Vlaanderen".

Jari Mikkelsen, Carole Ampe, Nathalie Cools, Yannick Devos, Stefaan Dondeyne, Katrien Oorts, Marnix Pieters, Roger Langohr. 2023.

Between the lake and the mountains: my field toolbox for recording soil and sedimentary characteristics important to understand archaeological sites on the northern shores of the Neuchâtel Lake (Switzerland).

Judit Deák

The northern rim of the Neuchâtel Lake is characterised by a large variety of landforms situated between the altitudes of about 429 m and 1200 m asl. Geomorphologically it is consisted of succession of lake-shores, alluvial plains, plateaus crossed by streams and eventually the more or less steep slopes of the Jura Mountain regularly cut across by large valleys. The sediments encountered are also very diverse: close to lake, the lakeshore, alluvial and marshy sediments are interfingering with deposits witnessing the passages of Pleistocene glaciers; higher up the bedrock composed of Jurassic and Cretaceous and sometimes Tertiary sediments are regularly covered by glacial, alluvial and slope deposits and peatlands. Moreover, throughout time, but particularly starting from the Neolithic onward, anthropic activities strongly affected soils, sediments and landscapes. In this context, the soils are also very diverse. Consequently, the soil and sedimentary characteristics to record during the archaeological operations are very numerous. These field campaigns require a fast documentation and evaluation of the features observed. In this framework, the use of standard recording sheets containing a long list of items to be checked might seem to be a good idea. Nevertheless, such an approach has its limitations: one should check an infinite number of features and the obtained list, in the best case, can feed databases, but does not provide the interpretation of the pedosedimentary environments and their evolution that are necessary to understand the presence/absence of the archaeological vestiges. To overcome these, a setting-oriented recording is developed and used. The talk aims to present the essential elements of this protocol. They are part of a toolbox that is successfully used in a strongly diverse preventive and programmed archaeology as illustrated by several examples to be shown.

Keywords: preventive archaeology, soil and sedimentary characteristics, field recording protocol

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Illustration

Soils, sediments and archaeological structures witnessing the complex history of the Bronze Age site of Hauterive / Long Champs - 2020 (Neuchâtel, Switzerland).

Credit: JS, Laténium.

From the field to the laboratory, proposed protocol for analysing embankments in an urban environment: the case of the ruau Sainte Anne (Tours).

Jean-Baptiste Rigot, Isabelle Gay-Ovejero, Florent Hinschberger, Nicolas Paillet

In an urban context, any prospecting of the subsoil generally involves the excavation of fill. Because of their complexity (organisation, stratigraphy, composition, origin, etc.), these levels are highly variable spatially and diachronically, raising questions about their characterisation and integration into palaeoenvironmental, archaeological and historical studies.

The "Tours, an island in the Middle Ages" project (TUIMA, ART Univ. Tours) aims to clarify the environment of the city of Tours in the late Middle Ages and early Modern period, based on sedimentary accumulations in the Loire-Cher alluvial plain. However, the numerous archaeological studies carried out in this area show the recurrent absence of natural deposits from this period, and in particular from the Little Ice Age (PAG). As part of the TUIMA project, research has focused on the lowest-lying areas likely to have preserved these sedimentary archives. One of the key areas is the ruau Sainte Anne. This channel, which once linked the Loire to the Cher, was definitively closed at the end of the eighteenth century, then filled in during the nineteenth century, to make way for the Tours Botanical Gardens. A transect of five cores (Eijkelkamp percussion corer), coupled with geophysical measurements (georadar and electrical surveys), was carried out in the southern part of the garden, followed by two further cores in its central part. A detailed description of the lithological units traversed down to the Cretaceous substratum and sampling were carried out. Observations made by Inrap colleagues over many years on sedimentary deposits in the Tours alluvial plain, and those made from coring in this palaeochenal, point to a possible confusion between natural levels and anthropogenic levels dating from after Antiquity. From top to bottom, the following sequence can be seen: dark sandy-silt levels with artefacts, unstructured sandy layers and then natural sandy or silty levels. What constitutes urban remediation? Embankments *sensu stricto*? Natural levels with artefacts? This difficulty of interpretation has led us to focus part of our research on identifying these deposits, with the aim of defining an analysis protocol and establishing a reference system. Our efforts are focused on detailed description in the field, followed by various laboratory analyses: particle granulometry and use of indices, spectrocolorimetry, magnetic susceptibility, binocular observations and 14C dating. The study, which is still in progress, should provide some answers to the questions raised by these soil archives.

[Translated with www.DeepL.com/Translator]

Keywords: embankments, sediments, geoarchaeology, palaeoenvironment, Tours.

Continuing education in the recognition of archaeo-sedimentary features in the field and in initial treatments: a challenge for all.

Morgane Liard, Frédéric Broes, Pascale Chevillot, Viviane Clavel, Kai Fechner

A one- to two-day training course entitled "Basic techniques related to soil and sediments: field reading and initial processing" has been offered for the past five years in Inrap's archaeological research centres. Its aim is to confirm, if not increase, the quality and variety of the initial information gathered in the field, by all those involved, before processing with GIS and statistical tools. The training is supported each time by one of the authors of the training and a geoarchaeologist from the centre in question. The same training is also given in three universities in France and Belgium, for students, in partnership with a local teacher. During the training courses, a strong match between the content of the teaching and the day-to-day needs of the actors in the field was noted. For example, common knowledge of certain basic notions of description is not always self-evident and a vocabulary accessible to all disciplines was therefore proposed. In addition, the manipulation and observation of oriented blocks and images enabled the participants to identify a selection of pedological and sedimentary features linked to human activities, which are well recognised and encountered in different types of contexts, depending on the regions and countries concerned by the trainees. Exercises in discerning texture, colour, calcareous or non-calcareous character, phosphorus richness and humus content or not, are also carried out. Finally, basic notions for the use of these observations in a spreadsheet and/or a GIS of the site are transmitted, which allow the cataloguing and mapping of this information from the diagnostic or at the beginning of the excavation site. This approach facilitates the reasoned choice of samples selected for analysis or, at the time of the diagnostic, makes it possible to define priorities in the event of prescription of excavation and post-excavation studies. The exchanges carried out on a daily basis on the sites with the other actors in the field (archaeologists, naturalists, prescribers, etc.) are another aspect of continuing education, complementary and not equivalent, which is being developed and whose first feedback will be mentioned.

[Translated with www.DeepL.com/Translator]

Keywords: continuing education, soil, sediment, soil feature, sedimentary feature, field description, geoarchaeology, vocabulary, P spot test.

Illustration

Colour comparison, direct and colour-coded, within blocks of burnt and dark layer structures

Credit: K. Fechner.

- 3 -
INTERDISCIPLINARY DIALOGUE: OPEN-AIR SITES

How to recognise the masked human impact at soils in archaeological context? Case study from the celtic *oppidum* of Bibracte, France.

Lenka Lisá, Sahar Poledník Mohammadi, Hana Grison, Aleš Bajer

Soils in archaeological contexts detected in hillforts and oppida are usually rich in anthropogenic elements. However, how to behave in situations where it is clear that the settlement was intensive, its duration is mistaken by historians for tens to hundreds of years, the location shows a number of building elements associated with the settlement and yet such a place does not show sufficiently intensively developed soils and the content of anthropogenic elements is very low. How to classify such sites?

Our case study is the Bibracte site, or the Bibracte *oppidum*. This location is a hill-top site on Mont Beuvray. The *oppidum* was restricted by two systems of fortifications as construction type murus gallicus. Bibracte reached its climax, shortly before its rapid abandonment after the beginning of the first century AD in favor of a new city, *Augustodunum* and was never fully populated again. The site was heavily influenced by human action during the Gallo Roman period, especially by the high rate of redeposition of geological substrate when forming the artificial terraces and large-scale deforestation. On the other hand, the amount of anthropogenic elements typical for the prehistoric anthropogenic soils are very low there.

In the past, we have repeatedly used classical environmental tools such as magnetic susceptibility, geochemical signal, micromorphology and environmental proxies to detect anthropogenic signals from soils. The results were not very conclusive. We therefore proceeded to a more complete study based on geochemical and pedological mapping of both archaeological sites within the oppidum and locations outside the *oppidum*. The sedimentary record inside the oppida was divided into several facies, namely subsoil, anthropogenically unaffected colluvium, anthropogenically influenced colluvium, cultural layer and recent soils. These facies types have been dated both archaeologically, using the C14 or OSL method. Their structure was investigated using micromorphology. The geochemical composition of these facies was detected using pXRF and the physical properties were further studied using magnetic susceptibility. Based on the combination of all these proxy data and the use of PCA analysis, it was possible to detect how to filter out the strong signal of the subsoil, which overlaps the relatively weak anthropogenic signal. This approach was only possible due to the comprehensive processing of not only the locality itself but also the soils located in the vicinity of the locality itself.

Keywords: archaeology, soil chemistry, soil micromorphology, multi-elementary analysis, magnetic susceptibility, Iron Age, *oppidum*.

Illustration

The oppidum Bibracte and surrownding landscape.

Credit: Lisá Lenka.

Identification of sedimentary units characteristic of fossil watercourses and depressions and their relationship with human occupation on the Nîmes plain (Gard, France). Contribution of geomorphology and bioarchaeology.

Pascale Chevillot, Sophie Martin, Isabel Figueiral, Marilyne Bovagne

The rapid development of the Nîmes conurbation and its alluvial plain over the last few decades has led to numerous archaeological surveys and excavations, boosted by the creation of the Collective Research Project "Rural space and land use in the Nîmes region, from prehistory to the modern era" in the 1990s. Very early on, a working methodology based on cross-referencing archaeological, geomorphological and palaeobiological data was put in place to better characterise the different sedimentary contexts, so that bioarchaeology specialists could be involved from the field phase onwards.

At the same time, the large number of logs systematically recorded in all the archaeological trenches provides a precise reference point for understanding the dynamics of deposition and soil formation. Combined with the archaeological data (soils, structures, furniture), they are needed to draw up longitudinal and transverse transects to characterise the palaeotopography, understand the taphonomy of the sites and the organisation of the different soil levels and/or human occupations. This approach is all the more essential in the Nîmes plain as the stratigraphy is particularly homogenised by bioturbation and early human occupation.

It has made it possible to identify specific sedimentary facies associated with the diverse landscape forms (paleocourses, interfluves, hydromorphic basins) that make up the Nîmes alluvial plain and which are now fossilised under the Holocene sedimentary cover.

The results of this systematic approach will be illustrated by various recent examples from the Vistrenque plain: two ancient depressions, ancient meanders of the river and the functioning of its paleoaffluents.

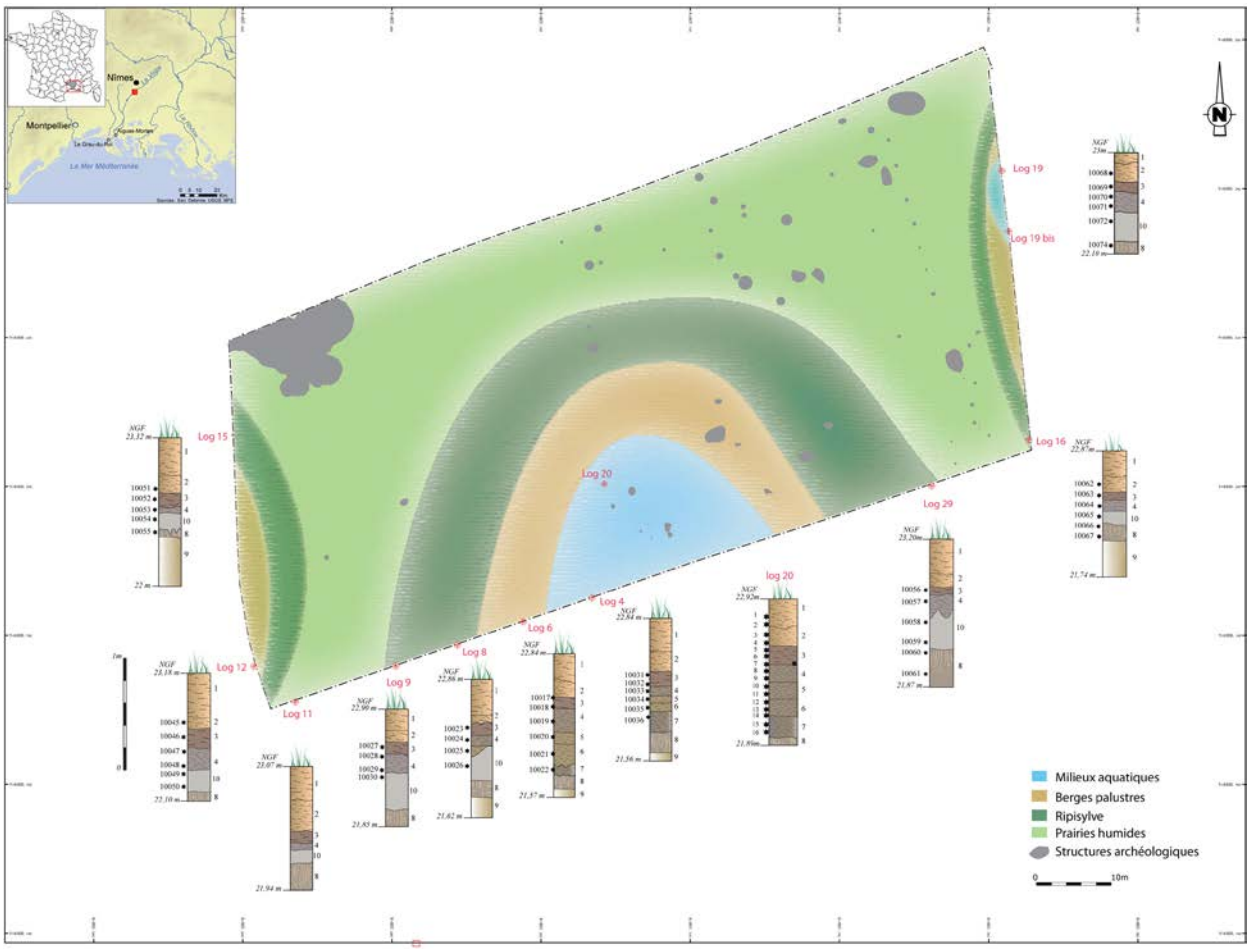
[Translated with www.DeepL.com/Translator]

Keywords: Mediterranean, Vistre, Gard, rivers, basins, geomorphology, palaeoenvironment, preventive archaeology.

Illustration

Depression of the Mas de Mayan site, an occupation from the Epipaleolithic to Antiquity in the Vistre plain (Nîmes, Gard, France).

According to: Stéphane Barbey, Sophie Martin, Pascale Chevillot. Extrait de Hélène Vergély (dir.). (2020). *Les abords du Vistre de l'Epipaléolithique à l'Antiquité, Mayan 6 : Occitanie, Gard, Nîmes* (Rapport de fouille, t. 1, p. 99). Inrap : Midi Méditerranée. https : //dolia.inrap.fr/flora/ark : /64298/0161120.



At the interface between lake, rivers and swamps: potentials and constraints of an interdisciplinary collaboration in the framework of a preventive excavation through the site of Yverdon-rue du Midi 35 (Vaud, Switzerland).

Judit Deák, Clément Hervé

The Yverdon-rue du Midi 35 site, was excavated between February and June 2020 in rescue archaeology circumstances. It unravelled traces of recurrent occupations dated between the timespan of Roman Empire and Carolingian period. Situated in a strongly dynamic sedimentary setting the archaeological vestiges witness a continuous adaptation of the habitats and various anthropic structures to the variations of the Neuchâtel level changes, to the more or less powerful inundations and to the repeated channel avulsions and incisions. In order to understand this complex environmental setting, the collaboration between the archaeologist and geopedologist during the field recording was the key element. This talk aims to overview the field recording strategies and methods that permitted the reconstruction of the changes in the environmental conditions throughout the time and the influence of them on the successive anthropic occupations.

Keywords: fluviatile, lake and palustral sediments, stabilisations and pedogenesis, settlements, river management structure, dark earth.

Illustration

Stratigraphic section showing the complex superposition of pedosedimentary events that record the environmental changes since de second Iron Age and of various occupations phases attributed to the time span between Roman Empire and Carolingian period.

Credit: CH, Archeodunum SA.

First results of the multi-parameter geoarchaeological study of the yardangs of El Deir, Egypt or: how to study ancient irrigation soils and canals in a desert context?

Mélanie Montalti, Jean-François Berger, Jean-Paul Bravard, Ashraf Mostafa, Aurélien Bolo, Pascale Ballet, Gaëlle Tallet

The archaeological site of El Deir, excavated by the French mission led by Gaëlle Tallet, in the Kharga depression (Egypt), raises many questions about the genesis and functioning of its agrarian landscapes. It was the subject of an initial geoarchaeological study (Bravard *et al.*, 2016) proposing hypotheses on ancient hydraulic management using artesian wells and the hydrogeomorphology of its watershed.

Now deserted since the mid-20th century after being abandoned for 1,500 years, El Deir was a strategic crossing point between the Nile valley to the east and the Kharga oasis, at the junction of two ancient roads. The site includes a Roman fortress, confirming its military importance, as well as a temple and necropolises dating from the Persian to Roman periods (6th c. BC - 5th c. AD). These remarkable sites are surrounded by several square kilometres of agricultural land, clearly visible on satellite images. Some were still in use at the beginning of the last century.

A further difficulty lies in the taphonomic complexity of the site, linked to the processes of eolian deflation. The only raised deposits on the site, yardangs 2 to 3 metres high, bear witness to the force of this erosion in this arid context, leaving only a few of these sedimentary ridges, the plot of land, scattered knolls, but also alignments of stones and flagstones that appear to be the remains of irrigation channels.

This raises questions about the past of this palimpsest landscape: how old is this plot of land? How is it connected to these shapes that appear to be canals? What can this agricultural organisation tell us about the ancient occupation and its water supply, at a time when aridification was already in place in the eastern Sahara?

But also, what is the nature of the deposits making up these yardangs, in which we observe multiple canal fillings, and irrigation soils, which we will call anthrosols?

In order to answer this question, we will present the initial results of the multi-parameter geoarchaeological study, supported by sedimentological and geochemical analyses carried out at the IFAO (Cairo) on samples taken from the natural sections of the yardangs. These analyses will be compared with the soil-sediment observations made in the field and the chronostratigraphic context (radiocarbon dates, ceramic chronotypology), which will make it possible to link the functioning of these deposits to the occupation of the site.

[Translated with www.DeepL.com/Translator]

Keywords: Egypt, western desert, Yardang, irrigation, canals, antiquity, anthroposols, aridification.

Bibliography

Bravard, J. P., Mostafa, A., Garcier, R., Tallet, G., Ballet, P., Chevalier, Y., & Tronchère, H. (2016). Rise and fall of an Egyptian oasis : Artesian flow, irrigation soils, and historical agricultural development in El deir, Kharga Depression, western desert of Egypt. *Geoarchaeology*, *31 (6)*, 467-486.

Illustration

Photographs of the El Deir site, Egypt. From left to right and top to bottom: Aspect of the main yardang studied (G. Tallet); Roman fortress on the site (B.-N. Chagny); Two of the yardangs present on the site and studied (M. Montalti); Canal reused in the modern era amidst the remains of plots of land.

Credit: M. Montalti.

Contribution of the multi-proxies approach to the identification of agrarian soils in a semi-arid environment

Hatem Djerbi, Sophie Costa, Aline Garnier, Pauline Garberi, Vladimir Dabrowski, Linda Herveux, Gourguen Davtian, Julien Charbonnier, Alain Carré, Louise Purdue

Oases, which are cultivated and irrigated landscapes in arid environments, concentrate the soil resources in arid and semi-arid biotopes. These areas are subject to climatic and socio-economic constraints impacting this resource / the soils ?

Within the framework of the ANR OASIWAT and the ArcAgr-AU projects (Dir. L. Purdue), an integrated, diachronic and multi-scalar analysis was developed in these not well studied environments, in order to identify in the soils the markers from the history of the oasis technical system. These markers are used to fuel the debate on their reasoned management, to understand their history, from their emergence to their artificialization, and to characterize the hydro-agrosystems that are specific to them.

Current reference systems were created in different areas (cultivated/abandoned/amended) of the Masafi (UAE) and AlUla (Saudi Arabia) oases. Surface and depth sampling were conducted to create and calibrate a marker record model based on paleoecological (malacology, phytolithology, anthracology), pedological (physicochemistry, geochemistry, micromorphology) and ethno-pedological approachs.

Results reveal a differential preservation of proxies. While the palaeoecological and particularly malacological references make it possible to identify different exploitation facies of the palm groves on the surface (irrigated, being abandoned, "open" areas, orchards), the in depth signature of these practices is more complex. Biases in the interpretation of palaeoecological assemblages, linked to taphonomic processes, demonstrate the necessity to combine these results with those of pedological analyses, which are key to identify irrigated, amended and degraded areas. These investigations make it possible to identify the durability of some practices as well as pedoclimatic constraints specific to certain periods.

The application of this model of current reference systems to archaeological sequences spanning several millennia, from different contexts, could reveal new soil features that could allow to:

1. Locate formerly cultivated areas;
2. Understand the practices that affected them;
3. Identify plant resources exploited in the past;
4. Discuss their socio-climatic significance.

The use of this approach allows a high-resolution determination of practices and socio-environmental variabilities structuring the landscape.

Keywords: agriculture, current reference frame, palaeoenvironmental reconstruction, geoarchaeology, malacology, anthracology, phytolithology, micromorphology, ethnography, Arabian Peninsula.

Illustration

View of the cultivated micro plots of the Masafi oasis (U.A.E.).

Credit: ANR Oasiwat.

Plateau silts at Tours: Holocene substrate or in situ palaeosols? Methodology for assessing archaeological potential.

Philippe Gardère, Céline Coussot, Morgane Liard, Mahaut Digan, Fiona Kildea

The Limons des Plateaux formation to the north of Tours is a collection of loessic deposits laid down during the Middle Weichselian. Studies of their texture, spatial distribution, origin and emplacement dynamics began in the 1970s. Since the 2010s, the increase in preventive archaeology operations in Tours and neighbouring towns has led to renewed interest in this formation on the part of geologists and archaeologists.

From 2015 onwards, the discovery of Palaeolithic occupations in the Limons led to the creation of a DTM to pinpoint high-potential areas. Additional resources were then devoted to exploring these areas. Archaeologists were trained to set up test pits in a regular grid pattern and to detect lithic material. This approach was made possible by taking into account, from the outset of the diagnostic work, the longer duration of the work involved. The systematic examination of the sequences by a geomorphologist was endorsed by both Inrap and the SRA. The studies concluded that there were two sub-units, characterised by different pedological mechanisms. A standard sequence was defined, with a median level of ferromanganic concretions located at the top of the lower sequence and constituting a key reference horizon. Interpreted as a palaeosol, it contains the vast majority of the material discovered during the surveys. A series of radiometric dates have been taken and an initial micromorphological study of the various contexts is underway. Progress in data acquisition has led to further modelling of the geometry of the deposits (DTM), which is the subject of regular publications in which correlations with sequences from other regions are proposed.

Initially considered by many archaeologists as simply the substratum of Holocene occupations, the Uplands Silts formation now has a radically different status. These deposits are now seen by the archaeological community as having great potential, confirmed by the discovery of 4 debitage heaps in 2022 alone. They document how the area was occupied and provide chronostratigraphic and environmental data for a sector that has hitherto received little attention, suffering from the poor development of Pleistocene sequences and its presumed status as a transition zone between the major regions of the Paris Basin and the South-West.

[Translated with www.DeepL.com/Translator]

Keywords: loess, Pleistocene, Middle Palaeolithic, preventive archaeology, Touraine.

Illustration

Limons de plateaux sequence, Avenue André Maginot, Tours (37).

Credit: Ph. Gardère, Inrap.

Variations in the function of spaces over time on archaeological sites, what geoarchaeological and archaeological field reading?

POSTER

Morgane Liard, Alice Tellier, Yannick Mazeau

The reading of the terrain on archaeological sites is multiple and depends on the affinities and experience of the archaeologists or geoarchaeologists involved. Depending on the specialities or approaches, it is possible to compare different perceptions of the stratigraphy, the soil archives more generally and the associated material remains. The richness of the observations made makes it possible to consider the sites in all their complexity in terms of the uses and functions of the spaces on the one hand and their variations over time on the other. The collaboration between geoarchaeologists and archaeologists opens up numerous perspectives in this respect. A few examples will be given, which illustrate the potential, notably the sites of "Les Grands Champs" at Meung-sur-Loire and "RD921-T6" at Darvoy, in a rural context.

One corresponds to a protohistoric occupation and the other to a medieval occupation, but it is not so much their chronological attribution as the evolution of the forms of their occupations that is important in this case. On these two sites, fine observations of the stratigraphy and soil-sedimentary features reveal occupation times that are not always perceived. At Meung-sur-Loire, a space of polylobed pits was reallocated for agricultural use, as illustrated by the furrows and cultivation horizons preserved in a section of stratigraphy in elevation. They testify to the fact that, once the extraction pits had been filled in, occupation continued in another form, exploiting an environment that had been enriched, in the agronomic sense of the term, by the anthropised filling in of the pits. The Darvoy site presents a group of medieval domestic ovens preserved in the major bed of the Loire, one kilometre from the current course of the river. The stripping was carried out in several stages, and allowed the reading of the soil-sedimentary features in three dimensions (in plan, in sections at different levels) and revealed other uses of the space than just the artisanal activity. The sandy accumulations caused by the recurrent flooding of the Loire were the subject of several cultivations, recorded in the form of furrows before and after the operation of the ovens. The adaptation to the whims of the river and the use of floods to develop another activity is remarkable and, until now, little known in the Val for this period and, above all, undated.

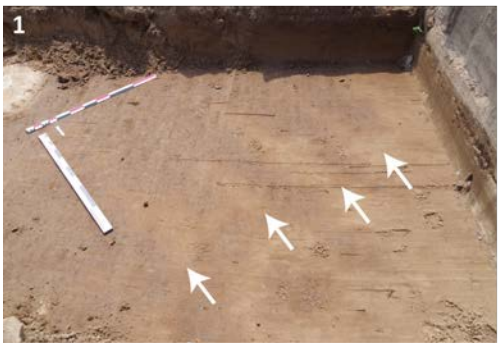
The archaeological objects mentioned are related to the reading of the soil but bear witness, in the same way as others, to the variety of human occupations; they take on their full importance when they are integrated into the archaeological reflection, the soil-sedimentary dimension opening up other perspectives for interpreting the human occupation of sites. The alternation of cultivation of more or less large areas with other forms of land use is an example of this.

Keywords: uses, functions, spaces, spatial and temporal variations, soil and sedimentary features, human occupations.

Illustration

Traces of cultivation, furrows recorded on the sites of Darvoy La Motte (photos 1 and 3) and Meung-sur-Loire les Grands Champs (photo 2).

Credit: M. Liard.



PCR ChroTAll 2022-2024: "Pleistocene chronostratigraphy of alluvial terraces between the Pyrenees and Massif Central. Palaeoenvironmental and archaeological implications for Palaeolithic sites".

POSTER

Julienne Piana, Manon Beauvillier, Teddy Bos, Laurent Bruxelles, Blanche Bündgen, Didier Cailhol, Juliette Capdevielle, David Colonge, Justin Guibert, Marc Jarry, Fabienne Landou, Laure-Amélie Lelouvier, Céline Pallier, Justine Vincent, György Sipos

Within the molassic formations of the eastern Aquitaine Basin, between the Pyrenees and the Massif Central, the valleys of the Garonne and its main tributaries are characterised by well-preserved terraced and/or interlocking systems. These vast alluvial deposits and the silty blankets associated with them, established in the Quaternary period, occupy a large area of the region and were logically heavily occupied by human populations in the Pleistocene period. Over the last few decades, the boom in preventive archaeology has led to the discovery of numerous Palaeolithic sites, renewing our knowledge of the archaeological series and their morpho-sedimentary contexts. Since then, new data has been accumulating at a steady pace, confirming the high archaeological potential and quality of the Pleistocene soil-sedimentary archives in southern Toulouse. Despite this, radionumeric chronological markers are still rare. While progress has been made for the most recent periods (Holocene), the Garonne catchment, in its middle section, still lacks reliable soil-stratigraphic and chronological frameworks for the earliest periods. This is all the more regrettable given that methodological advances have been made in dating these sedimentary contexts (geochronology) thanks to the development of OSL, IRSL, ESR and cosmogenic radionuclide methods. The need for an interdisciplinary research group to revise and strengthen the regional Pleistocene chronostratigraphic, palaeoenvironmental and archaeological frameworks has therefore become apparent.

The PCR "Chronostratigraphie pléistocène des terrasses alluviales entre Pyrénées et Massif Central. Palaeoenvironmental and archaeological implications for Palaeolithic sites", a three-year programme for 2022-2024, aims to improve regional knowledge of the Pleistocene chronostratigraphic context of the alluvial terraces and the silty blankets associated with them, with a view to placing the Palaeolithic archaeological series in reliable palaeoenvironmental and chronoclimatic frameworks. It is based on the inventory and processing of pre-existing data and the acquisition and analysis of new field data. It is divided into 3 thematic areas:

1. Morpho-stratigraphy and chronostratigraphy;
2. Technical and taphonomic characterisation of lithic industries;
3. Morphogenesis, palaeoenvironments and settlements.

[Translated with www.DeepL.com/Translator]

Keywords: geoarchaeology, lithic industry, alluvial terrace, chronostratigraphy, palaeoenvironment, Palaeolithic, Pleistocene.

Illustration

The Garonne valley from the slopes of Pech David (Toulouse).

Credit: J. Piana.

Contribution of field observations of Quaternary alluvial sedimentary formations. Contributions and limitations in a Mediterranean island context (Corsica).

POSTER

Marc-Antoine Vella

In situ observation and description of Quaternary sedimentary formations is a preliminary stage that complements laboratory studies. First of all, they enable us to propose an initial characterisation of their texture, structure and organic matter content. These qualitative characteristics are then used to construct initial hypotheses in terms of sedimentary dynamics and depositional environment. However, this approach is not sufficient to propose reference chronostratigraphies or to compare the intensity of the sedimentary processes studied. For this, quantitative data is necessary and can only be obtained from laboratory measurements. Two case studies in Corsica illustrate how field observation and laboratory analysis provide different but complementary information, and how they can be integrated to provide a coherent chronostratigraphic picture. Similarly, the rise of GIS shows the value of spatial studies for understanding sedimentary dynamics at the scale of a catchment area. Given the interdisciplinary nature of this method, an analysis strategy must be put in place from the very first phases of field observation, taking into account the subsequent stages of the study. The contribution, compilation and harmonisation of all field data and laboratory analyses in a common geo-referenced database is one of the avenues I am developing as part of my research and geomorphological and geoarchaeological diagnostic activities at Inrap.

[Translated with www.DeepL.com/Translator]

Keywords: geomorphology, geoarchaeology, fieldwork, sedimentary analysis, GIS, Corsica, Mediterranean.

A Late Glacial paleosol at Lommel Molse Nete. Discussing the nature of late glacial turbation processes.

POSTER

Bart Vanmontfort, Dave Geerts, Eckhart Heunks, Kai Fechner

The survey and excavations of an extensive site complex in Lommel (Campine region, Belgium) have disclosed the presence of a multiple hectares wide late glacial palaeolandscape. The diagnostic soil horizons of that landscape are preserved thanks to the 50 to 100 cm thick cover of Younger Dryas or early Holocene coversands and/or dune sands in which the Holocene Podzol soil developed. In this stratigraphy, the distinction of fine sub-horizons including post-depositional ones related to hydromorphy, is helped by diagnostic soil characteristics. It allows us to map the variability of the late glacial soil, grading from a typical 'Usselo' soil to a barely identifiable horizon. This poster focuses on this variability and the associated pedological features that can help the identification in future surveys elsewhere.

Keywords: Late Glacial, Federmesser groups, Usselo soil, Allerod, hydromorphy, diagnostic soil characteristics

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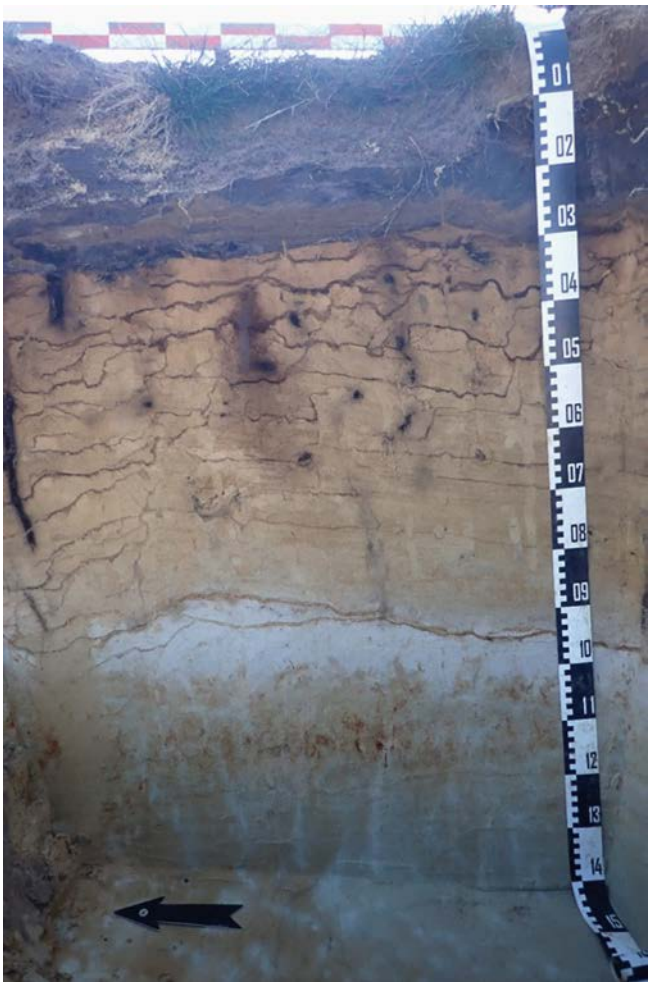
Illustration

View of one of the representative stratigraphy of the site of Lommel Molse Nete, showing both successive deposits and pedogenetical accumulations.

Credit: Bart Vanmontfort.



Geoarchaeological and palaeo-environmental approaches to the filling of natural depressions at the Saint-Germain ‘Les Balances’ and Laines-aux-Bois ‘Le Moulin’ sites: new data.

POSTER

Vanessa Rouppert, Grégory Dandurand, Frédéric Broes (coll.), Salomé Granai (coll.), Alexandre Monnier (coll.), Marie Grousset (coll.), Julia Wattez (coll.), Geneviève Daoulas (coll.)

The interdisciplinary studies carried out as part of two preventive excavations at Saint-Germain and Laines-aux-Bois in the Aube department show that the archaeological remains are associated with shreds of palaeosols and colluvial sequences preserved in a differential manner in depressions of various types and very variable size, which clearly incise the substratum. Preservation conditions are relatively good in these topographical hollows, and truncations are certainly less significant than on the surrounding slopes and plateau tops.

Geoarchaeological, stratigraphic and palaeoenvironmental studies, as well as analyses of artefacts and absolute dating (14C, OSL), have enabled us to put forward hypotheses on the formation and filling of depressions and palaeovalleys from the Tardiglacial to the present day. They also offer the possibility of gaining a better understanding of the dismantling of palaeosols of various ages on the scale of this study area in the south-east of the Troyes Plain. Finally, by combining the results of the various disciplines, we can propose a relatively detailed phasing for the occupations of the Early Protohistoric period and examine the interactions between productive social systems and cultivated ecosystems.

The approaches presented here demonstrate the importance of taking full account of the infilling of natural topographical depressions during the various stages of an archaeological operation, as these constitute veritable archives of the history of man’s development of the landscape. In most cases, this means carrying out deep boreholes, establishing a genuine dialogue between specialities on the basis of a common stratigraphic reference, changing the focus and relating the best-preserved contexts with the archaeological remains that are cut off from them.

[Translated with www.DeepL.com/Translator]

Keywords: geoarchaeology, palaeoenvironment, dating, natural topographical depressions, palaeosols, colluvium, agrarian archaeology, landscape, Plaine de Troyes, Holocene.

Archaeology and geomorphology of a hydromorphic palaeosol in the Ello-Rhenan plain: the example of protohistoric and ancient occupations at Horbourg-Wihr (F-68).

POSTER

Géraldine Alberti, Clément Féliu, Salomé Granai, Nathalie Schneider, Patrice Wuscher

Horbourg-Wihr is located on the Ello-Rhine plain, the southern half of which is structured by a vast cone of Rhine pebbles that have separated the courses of the Ill and Rhine rivers since the end of the last Ice Age. It lies at the foot of the Vosges mountains, immediately to the north of the present-day confluence of the Ill and Lauch rivers, and to the south of a vast marshland area, the Ried Centre Alsace, which is thought to have structured the settlement dynamics of the Alsace plain from the Neolithic period onwards. It is home to several protohistoric settlements and a large ancient town. The remains are located on a palaeosol developed on pebbles and presenting a dark colouration and marked hydromorphic characteristics. They are fossilised by overflow silt dating back to the end of Antiquity.

Since the 1990s, around a hundred preventive archaeological operations (diagnostics or excavations), totalling an area of 130 hectares, have been carried out around Horbourg-Wihr. These operations were accompanied by geomorphological surveys and digital dating (radiocarbon and optically stimulated luminescence/OSL). They were supplemented by micromorphological, malacological, palynological, carpological and palaeoparasitological studies. Synthesised in a cartographic database, the results show that the apparent homogeneity of the stratigraphic succession is deceptive. The plain was regularly swept by floods during the Neolithic and Protohistoric periods. However, the malacological content of these deposits indicates good drainage at the beginning of the 4th millennium BC, and therefore relatively incised channels. The development of a hydromorphic palaeosol therefore post-dates the 4th millennium, and predates the ancient period, as micromorphological studies of the levels from this period also indicate good drainage. Finally, although the base of the overflow silts shows hydromorphic features, these deposits complete the drainage of the area by raising it. The geometry and chronology of these deposits could reflect a sudden change in the course of the Ill, a hypothesis supported by historical sources.

These results call into question deterministic cultural approaches that presuppose the stability of marshy areas in the Rhine plain during the Holocene. They lay the foundations for a palaeogeographical reconstruction that now needs to be supplemented by pedestrian and geophysical surveys, auger sampling and an in-depth study of historical sources, in order to gain a better understanding of the history of the ancient and medieval settlement and, more broadly, to reconstruct the interactions between alluvial dynamics and land use in the Rhine plain.

[Translated with www.DeepL.com/Translator]

Keywords: palaeosol, hydromorphy, Protohistory, Antiquity, land use.

Illustration

Horbourg-Wihr, rue de Bretagne, view of hydromorphic palaeosol fossilised by Roman backfill, Schneikert excavation.

Credit: C. Féliu, 2011.

Evolution, occupation and use of a wetland, a geoarchaeological and palaeoenvironmental approach to the Grand-Plan and Besseye marshes (northern Isère) between the Iron Age and the end of Antiquity.

POSTER

Lia Vermot, Jean-François Berger, Elvyre Royet, Hervé Richard, Jacqueline Argant, Caroline Schaal

Occupation of the Vernai site (Isère) appears to have been long and continuous, with evidence of occupation as early as the Middle/Final Bronze Age. Several aristocratic occupations followed from the La Tène period until the end of the Middle Ages on an alluvial hillock at the centre of a large marshy basin, including a major Gallo-Roman villa. The siting of this agricultural estate in what was, at first sight, a difficult terrain raised a number of questions.

Geoarchaeological studies were first carried out on the Grand-Plan marsh, in which the villa is located, and on the Girondan some twenty years ago, to reconstruct human activities and developments and their impact on these environments, and also to understand hydro-climatic and palaeoenvironmental changes (Berger *et al.*, 2003; Royet *et al.*, 2006). In the marsh, hydromorphic palaeosols and several networks of plot and drainage ditches were intersected by mechanical trenches which, thanks to a chrono-stratigraphic approach, made it possible to propose correlations between the phasing of the site's evolution and the hydraulic networks.

A new project incorporating the neighbouring Besseye marsh began in 2021. It is based on a multi-indicator protocol incorporating several tools for characterising soils and their uses (X-ray fluorescence geochemistry, magnetic susceptibility, LOI, laser granulometry). It combines regressive landscape analyses (aerial photographs, old maps and cadastres, LiDAR) with cross-checking of fossil lineaments in the field. Palaeoecological analyses complete the reconstruction of palaeoenvironments and agro-pastoral activities (palynology, carpology, biomarkers).

The clogging of the ditches indicates alternating phases of landscape stability and phases with greater hydro-sedimentary flows (heavy rainfall, torrential events), as well as a desire to adapt in the face of hydro-sedimentary crises. The existence of several drainage phases has been demonstrated, mainly in connection with the Gallo-Roman villa at Le Vernai, from the time of its construction (40/30 BC). These networks were abandoned at the end of Antiquity and sealed off by a humus-bearing palaeosol that was stable for several centuries (7th-10th century), a reference horizon observed throughout the depression and on a regional scale (Berger, 2001). Analysis of the soil and sedimentary units has revealed evidence of use mainly as grassland, associated with crops (cereals, hemp, vines, etc.), clearing and cleaning by fire (charcoal), and soil enrichment (phosphorus).

This study, which is closely linked to the archaeological research, has shed light on the evolution of the marshes, the way they function and the environmental impact of this agricultural area.

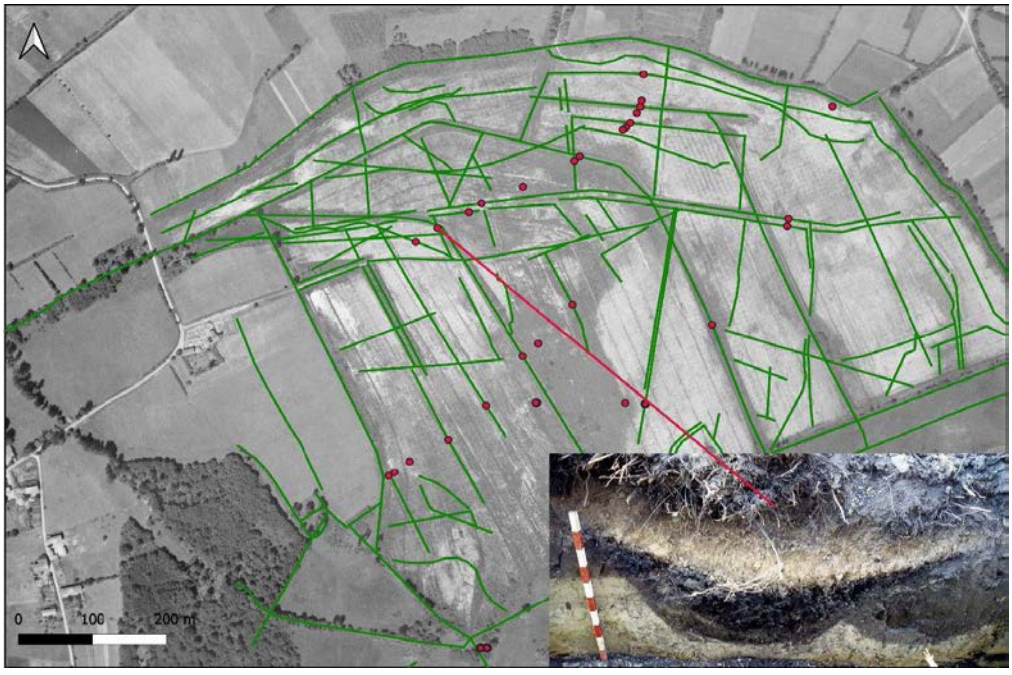
[Translated with www.DeepL.com/Translator]

Keywords: wetlands, drainage, irrigation, anthropisation, soil erosion, hydroclimatic changes, palaeoenvironment, geoarchaeology, geochemistry.

Illustration

Anomalies identified by photo-interpretation (green lines) and intersecting ditches (red dots) in the Grand-Plan marsh.

Credit: L. Vermot (sur fond IGN).



Implementation of geoarchaeological studies as part of a preventive archaeology diagnostic: the example of the La Novialle operation (La Roche-Blanche, 63).

POSTER

Magali Heppe, Gérard Vernet

A major occupation of the area during the 6th-4th centuries BC was revealed during an archaeological survey at La Novialle, at the foot of Gergovie, on the south bank of the Sarlième Basin.

The finds are quite remarkable in terms of their nature, the quality of their conservation and the material collected (new ceramic forms, ancient evidence of iron metallurgy, possible proto-urbanisation, etc.). They are part of a complex hydromorphic sedimentary sequence typical of the Limagne plain.

This site offers considerable potential for palaeoenvironmental studies. In fact, the site is located on the paleoberges of Lac de Sarlième. This lacustrine area has undergone major variations, with periods of low water (palustrine) alternating with periods of high water (lacustrine) in response to both climatic and anthropogenic controls.

The sequence characteristic of these semi-humid environments in which humans settled, from Protohistory to the end of Antiquity, is preserved under a significant sedimentary cover, up to more than 3.50 m thick. This stratigraphic power is the result of the lake's rising level before it dried up during the modern and contemporary periods.

For this operation, core samples were taken to a depth of 8 m, with the primary aim of helping to understand the spatial extent of the site associated with protohistoric occupation. The water table is higher today than it was in the 6th-4th centuries, and the flooding of the trenches has limited observations. However, the levels into which the remains are inserted have been perfectly identified, and their presence in the cores (in which furniture was found) has enabled us to estimate the surface area of occupation at a minimum of 7 ha within the prescribed area.

These cores will also allow us to study the entire sedimentary sequence, enabling us to reconstruct the evolution of the southern shore of the Sarlième palaeolake, particularly during Protohistory, and to understand how the levels of occupation relate to the phases of high and low water in the lake, as well as to the medieval period when the Sarlième lake experienced its maximum transgression.

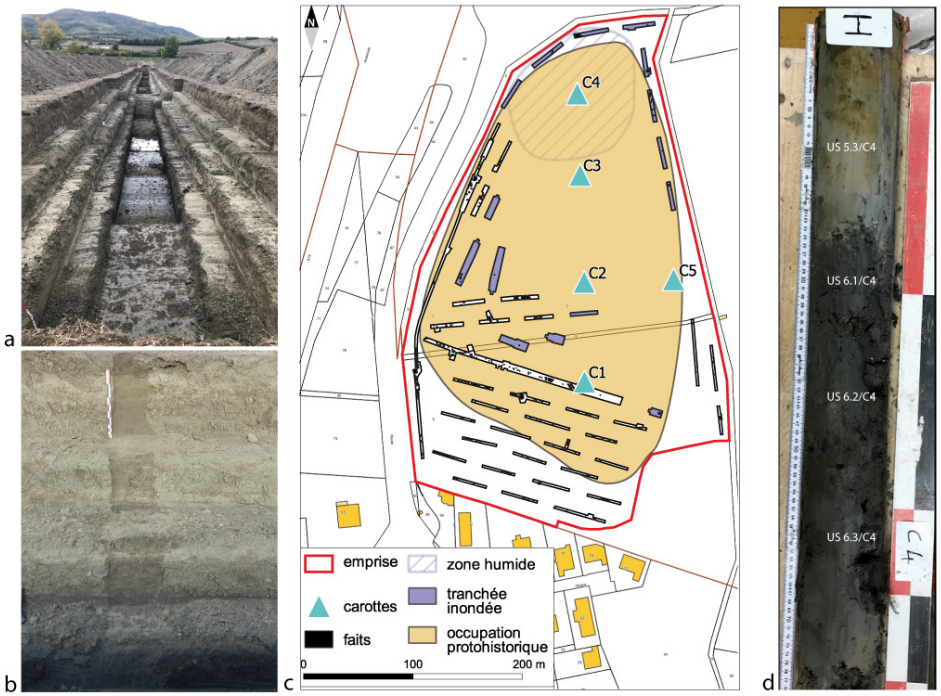
This operation provides a unique window of opportunity to observe not only micromorphology, but also carpology, palynology and anthracology. The samples taken yielded thousands of carporestes, the future study of which will contribute to the reconstruction of paleoenvironments.

[Translated with www.DeepL.com/Translator]

Keywords: archaeology, core drilling, diagnostics, palaeoenvironment, palaeolake, palaeobotany, geomorphology.

Bibliography

Heppe, M. (2022). La Roche-Blanche (Puy-de-Dôme), *Angle RD 978 et 979* (Rapport de diagnostic). Bron : Inrap Auvergne Rhône-Alpes. https : //dolia.inrap.fr/flora/ark : /64298/0168365



Illustration

a) View of a deep trench (4m) to uncover the ancient remains on the banks of the palaeolake. b) View of the sediment overlying the dark levels hosting the protohistoric occupation. c) Diagnostic plan illustrating the minimum extension of the 1st Iron Age occupation, the flooded trenches and the location of the prospective cores. d) Transition between the sediments filling the paleolake (light) and those hosting the protohistoric occupation (dark) observed in core no. 1.

Credit a-b-c: Magali Heppe. Credit d: Gérard Vernet.

- 4 -
INTERDISCIPLINARY DIALOGUE: CAVE SITES

An example of an integrated archaeological and geoarchaeological approach: the Middle Palaeolithic deposits in the Cotencher and Plaints caves (Neuchâtel, Switzerland).

François-Xavier Chauvière, Judit Deák

The programme defined in 2012 by the management of NAFO's Archaeology Section, which involves reinvestigating the Valleys and Mountains of the Neuchâtel region (Switzerland), has provided an opportunity to update scientific knowledge of the two sites in the canton that have yielded evidence of human occupation dating back to the Middle Palaeolithic: the Cotencher (Rochefort) and Les Plaints (Couvet) caves.

Explored in the late nineteenth century and then methodically excavated in the twentieth century, these two sites have been the subject of studies in the past that have helped to establish a framework of interpretative hypotheses about the history of their sedimentary fill. The aim of the recent return to the field at these caves was to re-examine the nature and methods of deposition of the various deposits and the degree of homogeneity of the archaeological assemblages they contain, while at the same time establishing the absolute chronology of the two sequences.

In these very specific contexts, where the variety and impact of natural processes and phenomena strongly determine the preservation (or otherwise) of traces of human activity - all the more so when the latter are very old - it was decided to promote the geoarchaeological approach as a structuring practice for archaeological excavation and study operations. Geoarchaeology is integrated into the formulation of archaeological issues (establishing a chronological and palaeoenvironmental framework for each of the sedimentary and archaeological sequences, defining the relationships between the remains of Palaeolithic human occupations and faunal remains, etc.). It guides the controlled dismantling of sediments even before the first trowel stroke, the recording of field data and the choice of samples to be taken for sedimentological, micromorphological and palynological analyses and for dating purposes (using IRSL and U/Th methods, in particular).

This presentation will show how the methodological structure that governs the field investigations and laboratory studies necessarily renews our knowledge of the Cotencher and Les Plaints archaeosequences.

[Translated with www.DeepL.com/Translator]

Keywords: geoarchaeology, Middle Pleistocene, Upper Pleistocene, Holocene, Middle Palaeolithic, archaeological digs.

Illustration

Cotencher cave. 2017 excavations by the NAFO Archaeology Section. Archaeologists and geoarchaeologists reflecting on the Str-5 stratigraphy.

Credit: M. Juillard, Laténium.

Rethinking archaeological deposits from caves and rock shelters of temperate region.

Diego E. Angelucci, Jacopo Armellini, Eusebio Jesús Medina-Luque, Maurizio Zambaldi

This paper aims to provide insights into and updates on the field characteristics and formation processes of archaeological deposits from karstic contexts. The main focus is on clastic infillings of caves and rock shelters in carbonate host rocks (limestone and dolostone) located in the temperate and Mediterranean regions of southern Europe.

These deposits are usually described as characterised by crude stratification, a predominance of coarse angular fraction with a variable quantity of fine interstitial material and poor textural sorting (see, for instance, Woodward & Goldberg, 2017 or Mallol & Goldberg, 2017). This description matches the average features of clastic sediments found at cave entrances and rock shelters. Nonetheless, geoarchaeological field expertise shows that the characteristics of cave and rock-shelter stratifications are varied and may sometimes depart from this generalised model.

A selection of case-studies from Portugal, Spain and Italy are presented here in order to describe some recurrent patterns of the sedimentary and post-depositional characteristics of the archaeological stratifications found in cave and rock shelters dating from the Pleistocene and the Holocene. The discussion will focus on the points as follows: the distinction between sediments from cave entrances and rock shelters with respect to the inner space of caves; the distribution of coarse clastic inputs and factors controlling their features in relation to the physico-chemical properties of the host rock; the characteristics of post-depositional features (among them, those related to bioturbation, secondary accumulation of carbonates or phosphates, redoximorphic processes and so forth), with respect to the layout and hydrologic behaviour of caves and rock shelters; the control exerted by microclimatic and environmental factors; the interrelationships between natural and cultural dynamics.

Keywords: caves, rock shelters, temperate region, Mediterranean region, field characteristics

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Bibliography

- Mallol, C. & Goldberg, P. (2017). Cave and rock shelter sediments. In : C. Nicosia & G. Stoops (eds.), *Archaeological soil and sediment micromorphology* (p. 359–381). Chichester : Wiley.
- Woodward, J. C. & Goldberg, P. (2001). The sedimentary records in Mediterranean rockshelters and caves : Archives of environmental change. *Geoarchaeology*, *16*, 327–354.

Anthropogenic structures at the Middle Pleistocene site of the Mas des Caves cave (Lunel-Viel, Hérault). A new look and the prospect of multidisciplinary studies.

Marie-Elea Coustures, Carla Giuliani, Laurent Bruxelles, Jean-Philip Brugal

The programme defined in 2012 by the The notion of an archaeological "floor" is often associated with the anthropic structuring of a so-called domestic space, revealed by visible or latent structures such as hearths, paving, walls or partitions, voids, concentrations, displaced objects, etc., associated with technical remains (e.g. lithic and bone industries, dyes), foodstuffs (bone remains of prey species) and even objects of symbolic value. A "soil" represents a thin, complex surface, constrained by a single or multiple period of occupation, followed by sedimentary and biological processes that will preserve, or disrupt, this structuring. The further back we go in Paleolithic times, the less easy it is to identify and read these soils and structures when they are preserved.

Cave no. 1 at Mas des Caves in Lunel-Viel (Hérault, or LV I) is a site dated to the end of the Middle Pleistocene. Its morphology (a relatively vertical entrance leading into a long horizontal gallery) has resulted in the formation of sedimentary layers in which the archaeological and palaeontological remains are packed. During early excavations (E. Bonifay, 1962-1982), a number of structures of human origin were reported (hearths, basins, paving and various fittings). However, these structures have been debated, their anthropic origin having given way to a sedimentary origin. One of the aims of the resumed excavations (J.-Ph. Brugal, 2019) is to verify the anthropic origin of these structures. We propose to test this hypothesis by combining geoarchaeological (geomorphological, stratigraphical, sedimentological), spatial and taphonomic approaches. The aim of this work is to determine whether, in the light of these new approaches, these structures can be attributed to human activity and therefore whether the levels on which they were discovered can be considered as archaeological soils. The aim here is to present the initial results of this multi-faceted, multi-scalar approach, in order to contribute to the debate on the notion of prehistoric "soil".

[Translated with www.DeepL.com/Translator]

Keywords: cave, Languedoc, Middle Pleistocene, archaeo-paleontology, history, structures, geoarchaeology, taphonomy.

Illustration

Photo of the Mas-des-Caves cave.

Credit: J.P.Brugal.

- 5 -
BLACK SURFACE HORIZONS AND DARK EARTHS

Black Earth Relics in the Rhineland from an Archaeological Perspective.

Renate Gerlach, Eileen Eckmeier

In the Lower Rhine basin, dark soil horizons have been uncovered in subsoils of mainly Loess-derived Luvisols during archaeological excavations. These soil horizons have traditionally been considered to be the remains of a formerly extensive and naturally formed chernozem.

According to this model, such a fertile black soil, that is today common in steppic environments, should have been the soil that the first Neolithic settlers found and used for cropping (Linear Pottery Culture, from about 5,000 BC). Large-scale excavations and archaeological prospection (e.g., during open-trench pipe-laying) revealed a patchy or island- like distribution. Furthermore, the dark horizons were usually connected to archaeological structures such as pits, slot pits and tree burrows. We called those findings the "black earth ensemble" because they are characterised by the same soil material. Due to the lack of archaeological artefacts, the features were often not recognized as such, but viewed as natural structures, just like the horizons. These observations, however, led to the suspicion that the "black earth ensemble" is actually an artefact itself. This was confirmed by pedological and soil chemical investigations, and by radiocarbon and OSL dating methods. As a result, it was proven that it is primarily pyrogenic carbon that is responsible for the dark colour. These fire residues were produced during man-made fires and are an evidence of a Neolithic fire-based economy that can be dated mainly to the late Neolithic. There is evidence for Neolithic fire-based economy also in other regions, as it was proven by archaeobotanically data. It is a method of agricultural management, which made it possible to use also suboptimal or less fertile soils, e.g., in sandy and loamy areas.

Keywords: archaeopedology, dark horizons, dark features, prehistoric soil management

A matter of scale: urban geoarchaeology in Brussels and Flanders.

Yannick Devos

A good knowledge of soils and sediments is mandatory in urban archaeology. Beyond being the matrix surrounding artefacts and ecofacts – either protecting or degrading them – soils and sediments witness of ancient human activities and natural events. However, their study is often a delicate and complex exercise. The reasons are manifold:

- urban areas are characterized by multiple occupation phases, including recutting and levelling events, often involving many long- and short-time formation processes,
- excavation trenches are often small, leading to restricted observation windows,
- sequences often tend to be extremely deep,
- time constraints, etc.

In Brussels, a specific interdisciplinary research protocol has been developed over the last decades to face this complexity (Devos & Degraeve, 2018). More recently it has also been applied on series of Flemish towns (Devos *et al*., 2020). Within this protocol a central place is occupied by multi-scalar geoarchaeological observations ranging from regional down to site and microscopic level.

Through a series of case studies present contribution intends to illustrate:

- how this multi-scalar geoarchaeological research in Brussels and Flanders contributed to a better knowledge of the urban stratigraphy, including the understanding of site formation processes, human actions and natural events, and their chronology,
- how it integrates within the broader research protocol,
- to what extent this research can contribute to our understanding of the urban development, including the organization of space, patterns of waste management, etc.

Keywords: urban archaeology, multi-scalar approach, soil formation processes, stratigraphy

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Illustration

Example of a thick and complex urban stratigraphy resulting from multiple occupation phases (site of Rue du Chevreuil, Brussels, Belgium).

Credit: Yannick Devos.

Understanding manures and their black layers, a fieldwork and multidisciplinary discussions.

Morgane Liard, Sandrine Bartholomé, Jérôme Besson, Céline Coussot, Fabrice Couvin, Laure Fabien, Laurent Fournier, Jean-Philippe Gay, Aurélien Hamel, Geoffrey Leblé, Mathilde Noël, Gregory Poitevin, Émilie Roux-Capron, Pascal Verdin, Franck Verneau, Carole Vissac

Manures, dung pits or manure pits are all names attributed to excavated pits or arranged depressions, commonly identified in the *pars rustica* of rural settlements in Antiquity. In the Centre region, many archaeological sites from these periods present such structures, generally characterised by their imposing size (50 to 150 m^2 on average, sometimes even 200), their excavated nature, a flat bottom, the possible presence of a floor, walls surrounding them, but also sedimentary and pedological features specific to their infilling. If an occupation layer is sometimes identified at the base of the stratigraphy, or associated with the invert, the filling is generally very homogeneous, humus-bearing (black to dark brown in colour) and pediments (biomacrostructured horizon), topped by a fill or a colluvial deposit that seals the stratigraphy.

Their recognition in the field and the definition of a suitable excavation and sampling strategy are of some importance in the context of the more general problems of ancient rural settlements, relating to the question of amendments, the definition of terroirs and the agrarian economy more generally.

These large excavations are sometimes attributed to ponds or extraction activities, a confusion that is often cleared up in the field by macroscopic observation of various sedimentary and pedological features and the study of their general morphology. However, these hollows also present a variability in their functioning, depending on anthropic interventions and seasonal natural processes, themselves subject to the morphology of the depression and the state of the surrounding soils: thus, the initial function of extraction is not always excluded, nor is the possibility of seasonal or permanent water stagnation. The networks of drains and the juxtaposition of large pits also suggest a complex management of run-off and/or waste water (from artisanal or agricultural activities).

Finally, the results of analyses such as soil micromorphology and physico-chemical analyses testify to the variability of the pedo-sedimentary records, inviting us to revisit the initial simplification of the interpretation of the deposits and the uses associated with them. Although the "black layer" is very homogeneous, it can be of various natures, and the term ‘manure pit’ thus refers to a broader management of organic waste. In this respect, these structures are all the more interesting as they are one of the key elements in the perception of the ancient agropastoral ecosystem.

This multidisciplinary presentation will address the stages of field characterisation of potential dung pits and the definition of a sampling strategy adapted to their study, based on current knowledge and taking into account the questions currently being asked about them, particularly in the Centre-Val de Loire region, but not exclusively.

Keywords: Antiquity, black layer, depression, manure, walls and inverts, farm building, plant residues.

Illustration

The example of excavation F.945 at Meung-sur-Loire Les Grands Champs, a potential manure pit.

Credit: P. Juge.

All the same but different? – Anthropogenic Dark Earth on a global scale.

POSTER

Jens Schneeweiß, Eileen Eckmeier, Paweł Cembrzyński

Since the 1980s, the term "Anthropogenic Dark Earth" is appearing in pedological and archaeological publications, and their original description was conneced to European Roman and medieval urban contexts. They are usually characterised as soils with thick and homogeneous dark horizons with little to no visible stratification. They are rich in organic material and charcoal, which gives them their characteristic dark colour.

Since the first description, development of research, especially in geoarchaeological analysis, has revealed a great variety of possible origins of Dark Earth. Such soils appear in ancient rural and urban settlements, in many chronological and geographical contexts. They are an archive of information concerning environmental and social change, subsistence and resilience strategies.

While the growing number of case studies investigating the Dark Earth phenomenon shows increasing interest in this soil, a coherent research methodology is still lacking. This makes comparative studies on a global scale considerably more difficult or even impossible.

In October 2022, the interdisciplinary workshop *Anthropogenic Dark Earth Colloquium* (ADEC) in the framework of the Cluster of Excellence ROOTS in Kiel (Germany) made a first step towards a comprehensive understanding of the Dark Earth phenomenon from a comparative global perspective. Leading specialists in this field discussed the development of a coherent interdisciplinary research methodology for both, approaches to soil analysis and interpretations in social and environmental contexts.

It was decided to publish the results of the colloquium as a kind of handbook with a practical guide, bringing together experiences and perspectives from different scientific areas and disciplines. The initiative for the ADEC came essentially from archaeologists, and they are also the main target group. The authors are mainly geoscientists, but also archaeologists. The general aim is to make field archaeologists aware of the Dark Earth phenomenon and to enable them to recognise, preserve and sample these soils. We will present the publication project and the main methodological approaches as well as some field experiences.

Keywords: dark earth, methodology, sampling strategy

Acknowledgements: The preparation of this paper was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation under Germany's Excellence Strategy – EXC-2150 – 390870439).

Understanding black earth in the field in a preventive context: a few examples from Bourges (France).

POSTER

Mélanie Fondrillon, Carole Vissac, Kai Fechner (coll.)

Recent preventive archaeology excavations in the historic centre of Bourges have uncovered a number of dark, homogenised deposits dating from various periods, from the end of the La Tène Final to the Late Middle Ages. The identification of these "black earth" facies deposits was based on a number of sedimentary criteria, applied in the field by archaeologists and geoarchaeologists.

During the excavations, these levels were apprehended by combining a traditional archaeological approach (fine excavation, recording, stratigraphy) and a geoarchaeological approach (fine macroscopic description and study in sequences, chemical tests, colourimetry). The excavation of these levels, combined with the collection of archaeological material and multiple sampling (micromorphology, geochemistry, palynology, microarchaeology, etc.), highlights the diversity of deposits and environmental conditions associated with the use of activities and spaces.

The methodological prospects include the development of a stratigraphic, geoarchaeological and spatial approach to black earth from the field phase onwards, the application of routine protocols for analysing soils and their constituents, and finally reasoned and problematised sampling and securities studies, with the integration of specialised studies into the entire archaeological process.

[Translated with www.DeepL.com/Translator]

Keywords: Bourges, black earth, geoarchaeology, sedimentary facies, field methodology, pedological features.

Illustration

Plan view of a black earth sequence dating from La Tène D2 on the Séraucourt slopes site.

Credit: Bourges Plus preventive archaeology service.

Dark soil on sand dunes as a result of terrain levelling and tillage at the early medieval **settlement of Mikulčice, Moravia.**

POSTER

Martin Petr Janovský, Lenka Lisá

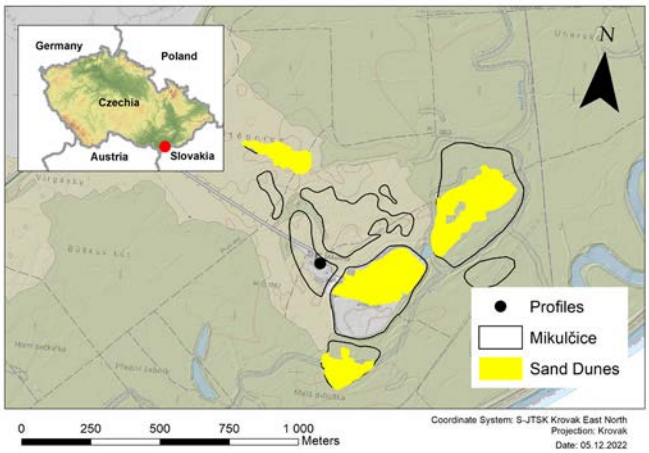
At the early medieval Great Moravian site of Mikulčice-Valy (8th-10th century AD), a metre-thick set of anthropogenic horizons of dark color mixed with sand from the local dunes were found during rescue archaeological excavations. Archaeologists usually consider similar finds to be cultural layers because they are full of artifacts and ecofacts. It is the question if such general interpretation is sufficient. In order to reveal the formation processes of this humus-rich horizons in detail, the physico-chemical analyses, micromorphological analysis together with archaeological interpretation were carried out. Based on micromorphological analysis, it is clear that this is not a cultural layer, but rather a Dark Earth that is physico-chemically influenced by the formation and gradual anthropogenic mixing with sand dunes. The sand in this case was used to level the terrain after the demolition of older early medieval buildings. As a result of the gradual mixing with organic waste, bones and excrements, black horizons were subsequently formed. But these black horizons are also the result of tillage. It is thus one of the oldest micromorphologically described tillage in the Czech Republic.

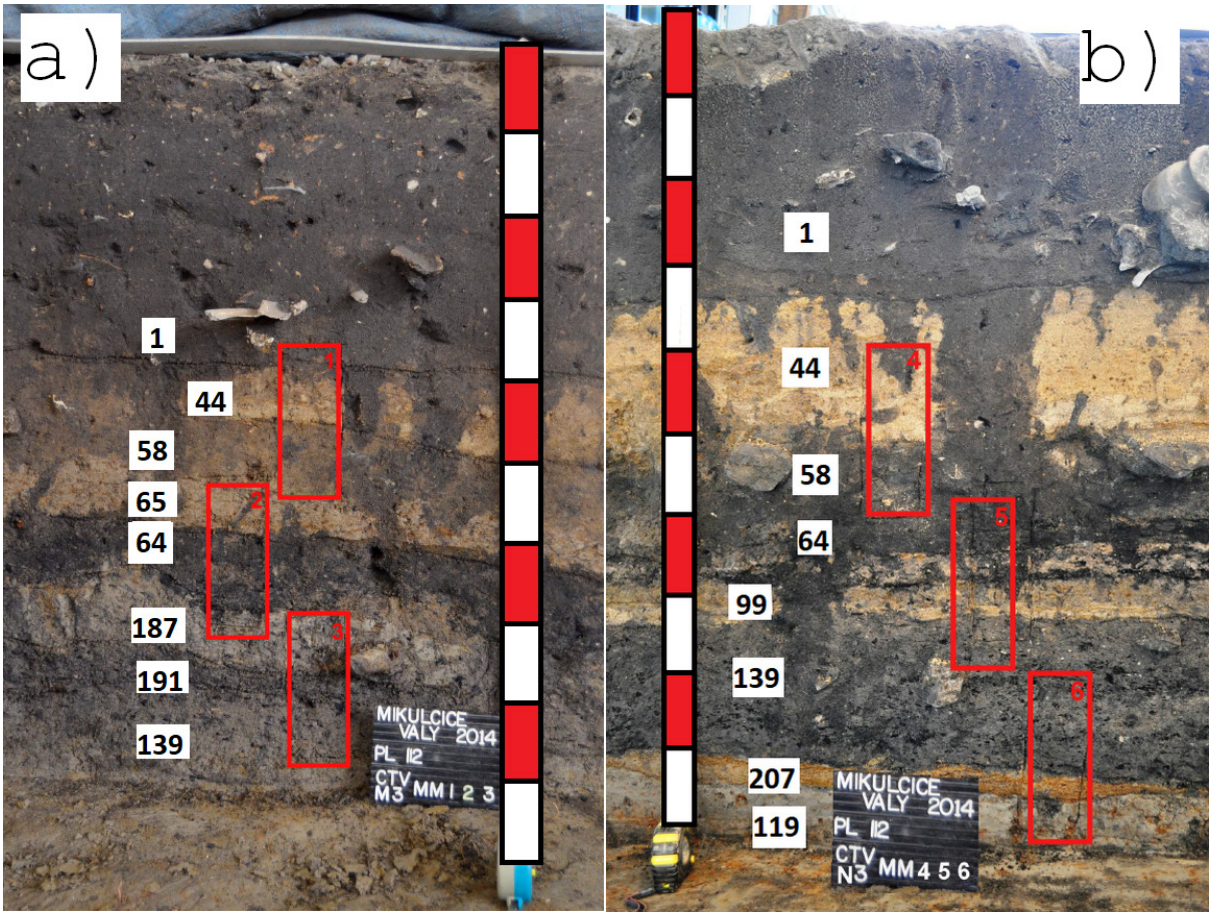
Keywords: Early Middle Ages, Great Moravia, dark earths, anthropogenic soils, micromorphology.

Illustrations

1 - Location of the site Mikulčice in south Moravia, Czech Republic.

2 - Photos of the profiles studied: profile 1 (a) and 2 (b). Red numbers correspond to the number of “Thin section”. The yellow-coloured sandy layers are the levelling of the terrain. On the other hand, the dark layers are of purely anthropogenic origin.





"Are friends acidic ?": differentiating humiferous Neolithic occupation horizons.

POSTER

Kai Fechner, Frédéric Broes (coll.), Adrien Gonnet (coll.)

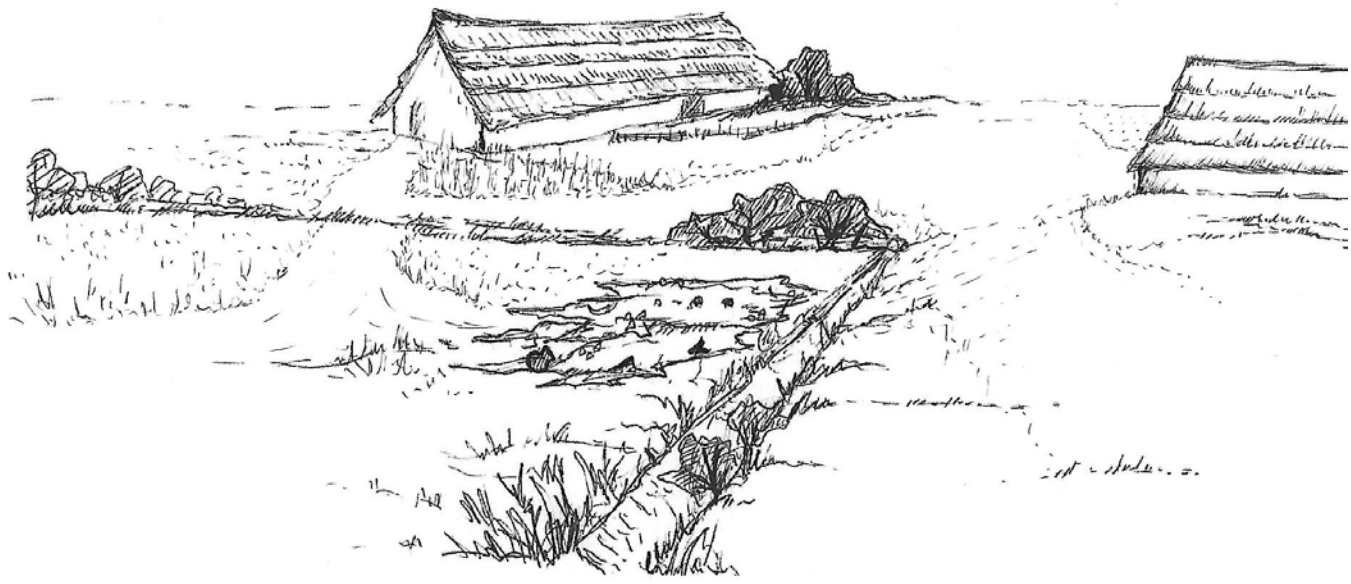
In the field, finding well-dated and well-conserved Neolithic surface horizons is rare and implies a consciousness of its importance and morphology, by the archaeologists and geoarchaeologists. Further steps then contribute to the recognition of different main types of surfaces. In the study area, over numerous years, they have involved the use of field characteristics and tests, the differentiation of soil forming factors and preservation conditions in calcareous and acid soils, the choice of adapted analytical methods according to these (as mineral chemistry, micromorphology and malacology) and finally, to take into account the soil conditions encountered in the Neolithic. These evolve strongly in one of the treated sub-regions, changing from calcareous to acidic during Early and Middle Holocene. Results of these approaches concern in situ human activities recorded by these surfaces, for a dozen cases in Northern/ Central France and Belgium/ Luxembourg and may encourage more research on this topic.

Keywords: Neolithic, Mesolithic, surface horizon, forest fire, cultivation, house floor, yards, soil evolution, soil analysis, soil fertility.

Illustration

Hypothetical reconstruction of the soil use between the Late Neolithic houses on the site of Sauchy-Lestrée (Pas-de-Calais, France), studied by soil science.

Drawing: Cécilia Populaire.



- 6 -
DETECTING AND UNDERSTANDING ARCHAEOLOGICAL STRUCTURES : PITS

Reading the pedosedimentary filling of excavations: contributions from the geoarchaeological study of Neolithic and protohistoric pits at the Clos de Roques site in Saint-Maximin-la-Sainte-Baume (Var).

Maëlys Cizeron, Benoît Devillers, Mathieu Rué, Johanna Recchia-Quiniou, Alda Flambeaux

Due to erosive processes, the backfill of archaeological excavations often constitutes the only archive of the soil surface horizons contemporary with the areas occupied. The archaeological, faunal and palaeoenvironmental content of these excavations is therefore given priority. The sedimentary fill, which often makes up the majority of the volume of the structures, is rarely considered beyond a simple stratigraphic description. Only in very rare cases are the fill units studied in depth, including, for example, an analysis of soil and sedimentary facies at macro- and microscopic scales.

However, the stratigraphic units and their spatial organisation within the volume under consideration provide a wealth of information about the use of the excavations, human practices and, on a broader scale, the function of the site. The aim of this presentation is to present a methodology adapted to the study of the sedimentary filling of domestic pits using a cross-referenced approach based on harmonised stratigraphic and micromorphological data, as well as ideas aimed at optimising field recordings. This method and the initial results obtained will be illustrated by the example of the Clos de Roques district, located on the southern edge of the Saint-Maximin-la-Sainte-Baume plain, where numerous pits dating from the Middle Neolithic to the Early Iron Age have been studied in the course of around ten preventive operations. The size of this site, and the discovery of several hundred pits dug into a relatively homogenous silty substratum, provide an opportunity to gain a better understanding of the methods and dynamics of filling these frequently-found structures.

[Translated with www.DeepL.com/Translator]

Keywords: pit, soil-sediment filling, geoarchaeology, micromorphology, database, spatial analysis.

Reading and interpreting Neolithic pits in a non-calcareous silty environments: from field characteristics to analyses.

Kai Fechner, Dominique Bosquet, Alexandre Chevalier, Aurelie Salavert, Françoise Bostyn, Patrick Lemaire (coll.), Julia Wattez (coll.), Michel Kasprzyk (coll.)

A collaboration between archaeologists and archaeo-environmentalists has led to the recognition of pits with similar shapes and stratigraphy in Early Neolithic sites of Belgium/Luxembourg/North-eastern France, on the one hand, and in Middle Neolithic sites in Picardy and Champagne, on the other. All are located on well-drained non-calcareous clayey silts. Most of the well-defined and well-dated pits on these Early Neolithic sites are interpreted as silos, but some have features on their bottom that could refer to other functions. The Middle Neolithic cases are all 'Schlitzgruben', with an interesting variability of soil features and contexts.

The detailed and archaeopedological systematic study of certain layers in those pits was carried out in the field. It concerned particularly dark to black inferior deposits, sometimes other soil characteristics. It was followed by botanical (anthracology, carpology and phytoliths) and sedimentary analyses (micro-morphology, physico-chemical analyses).

The contribution focuses on two Early Neolithic pits in Belgium and two pits of a Middle Neolithic II pits in France, that are particularly enriching in terms of understanding the activities and environments. It presents, on the basis of in-depth fieldwork, the choices of sampling and analysis and the results obtained by cross-referencing these data.

Keywords: pit, settlement, Neolithic, Belgium, Northern France, lœss, soil science, archaeobotany, multi-proxy.

Illustration

View of one of the profiles through pit n° 6 of Remicourt "En Bia Flo" II that includes two homogeneous dark layers.

Credit: D. Bosquet, AWAP.

Towards an integrated approach to medieval silos in Auvergne: excavation protocol and sampling strategy.

Antoine Scholtes, Julie Charmoillaux

On the field, the excavation of silage pit fills is usually minimal and stratigraphic records are often schematic. This loss of information is largely the result of a poor stratigraphic analysis of the dynamics of the fills, which limits our understanding of the nature and rhythm of the fills. Indeed, although the fills rarely provide an image of the storage itself, their taphonomic observation produces data on silage management. However, these sedimentary observations alone are not always sufficient to reveal the existence of specific features such as the treatment of the walls (linings), the closing plugs and other functional features linked to the construction of the pit.

In Auvergne, the recent preventive archaeological operations carried out by Inrap have been an ideal working laboratory for thinking about the implementation of a specific protocol combining field observations (extensive stratigraphic recording) and samples (micromorphological, sedimentary, physico-chemical, archaeobotanical, biomolecular if necessary, etc.).

The first hypotheses highlighted by micromorphological studies provide information on different categories of microfacies linked to the evolution of the phases of use. Called "primary microfacies", "secondary microfacies" and "abandonment microfacies", they trace part of the life of the pit and its abandonment. Although they are often clearly individualised within the stratigraphy (basal fill, summit fill, excavation interface, etc.), they are also likely to be amalgamated in the case of complex or interbedded fills The acquisition and evaluation of these data can then provide a concrete observation framework in the field to understand the sedimentary processes at work and a decision-making aid to adapt sampling strategies to well-defined criteria and issues. The aim of this paper is to present this feedback, which is the result of a rich dialogue between the prescribing archaeologist, the field archaeologist and the specialists.

Keywords: storage pit, archeology, Auvergne, micromorphology, sedimentary microfacies, sampling strategy

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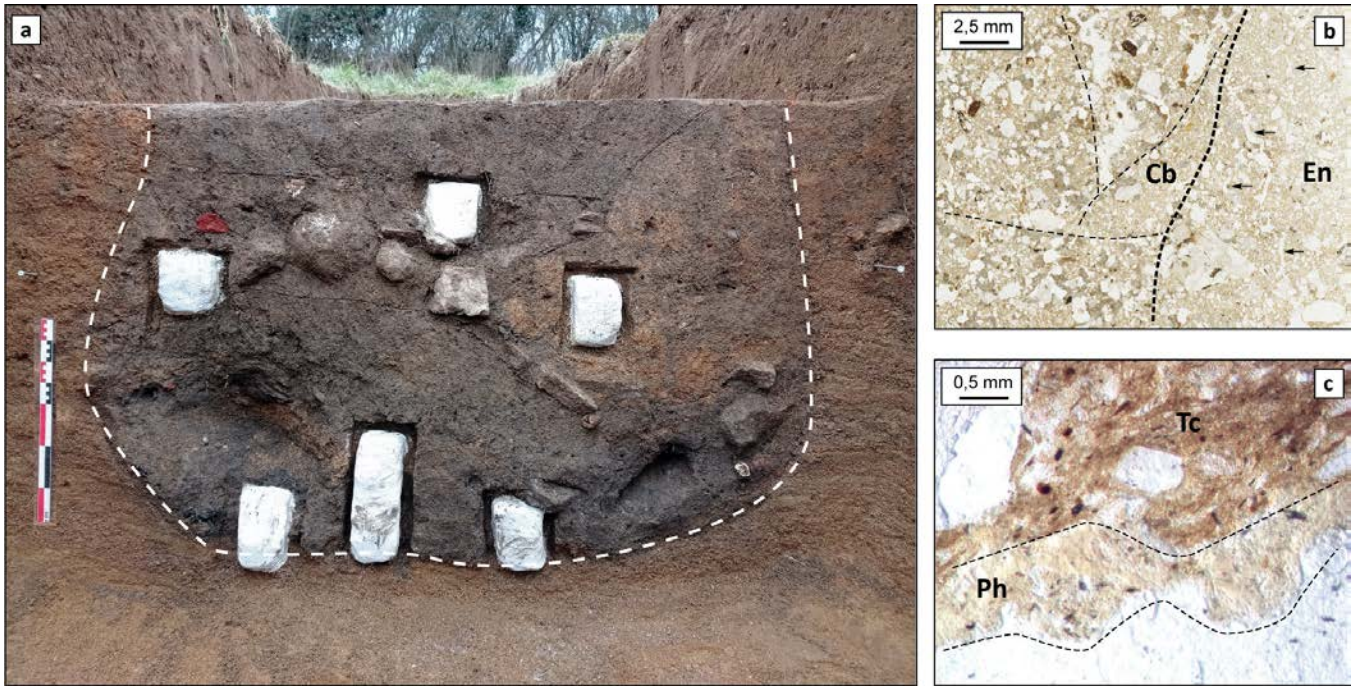
Illustration

Cross-section of one of the silos at Prieuré de Reugny (Allier, 03) and details of some microfacies revealed by the micromorphology of the soils: b) vertical compaction of the walls of the casing (En) and traces of combustion (Cb); c) lamellar phosphatic beach at the base of the filling (Ph), covered by a massive aggregate of raw earth (Tc).

Credit: A. Scholtès, Inrap.



Presentation of some atypical structures in a wet environment: the examples of the Waziers (59) "Bas-Terroir" and Sains-en-Gohelle (62) "Avenue de la Fosse 13" sites.

POSTER

Samuel Lacroix, Frédéric Simon et Carole Vissac (coll.)

In recent years, excavations at a number of wet sites in the Nord and Pas-de-Calais regions have uncovered remains with similar characteristics, but whose use remains uncertain. These structures, with their atypical morphology, have been found in a geographical area covering the Douaisis, Artois and Gohelle regions.

On all of these sites, these remains appear and disappear during the Early Period and seem to bear witness to an activity which, in this form, appears to have no equivalent in Protohistory and is not attested to in later periods.

The structures take the form of a long main pit, which can reach large dimensions (up to more than 60 m long and more than 3 m wide), flanked on one side by quadrangular external features, the number of which seems to be in keeping with the size of the main structure. These features are evenly spaced and all have the same gently sloping profile towards the main pit.

In rare cases, the excavation uncovered internal devices, other than remains of the «bank maintenance» type, to regulate the circulation of water within the complex. Sometimes, as at the Sains-en-Gohelle site, a border resulting from the precipitation of iron oxides highlights the bottom of the structures.

During the excavation at Waziers "le Bas Terroir", a series of sediment samples were taken in an attempt to identify the function of these features. Whatever artisanal activities were carried out (retting, currying, fishponds, etc.), the results of the micromorphological study clearly show significant variations in the water regime in these structures, where water is always present and appears to be active. It also indicates the concentration in the fill of a degraded fine organic component in the form of phytoliths, which will need to be characterised in future analyses.

[Translated with www.DeepL.com/Translator]

Keywords: typical structure, wet context, artisanal activity, micromorphology.

Illustration

Structure 2043 uncovered at the Waziers le Bas Terroir site in 2013.

Credit: Frédéric Simon, CADDAP.

Choisy-au-Bac (Oise), Sect. 1 - D2 to D4: a Mesolithic pit, recognition of pedological features and methodology as part of the diagnostic.

POSTER

Anne-Lise Sadou, Kai Fechner, Salomé Granai

As part of the project to build the Seine-Nord-Europe canal, a series of surveys were carried out in the commune of Choisy-au-Bac in the Oise department in 2022. During this work, a cylindrical pit with a central overburden was uncovered (UE 2042). It has been radiocarbon dated to 6690+/- 30 BP, or 5666-5537 cal BC (Beta-647423). This type of remains is still rarely recognised in the region, unlike the many examples in Champagne: Recy (Marne), Marnay-sur-Seine or Savière (Aube). Certain features of the terrain appear to be recurrent and characteristic of these cylindrical pits, while others need to be qualified. The Choisy-au-Bac pit has a number of clearly recognisable soil features that explain the nature of this structure.

How should these features be recognised and characterised in a diagnostic context? This example looks at these features and the initial laboratory data, such as micromorphology and malacology, and puts them into perspective.

[Translated with www.DeepL.com/Translator]

Keywords: Mesolithic, cylindrical pit, post, pedology, micromorphology, malacology.

Illustration

Cross-section of pit 2 042, looking south.

Credit: A.-L. Sadou, Inrap.

From pond to basin: a multi-disciplinary approach to an exsurgence exploited from the Early Empire to the 1st Middle Ages..

POSTER

Brice Chevaux, Yann Petite

During a preventive excavation carried out by the Nice Côte d'Azur Archaeology Department in 2020, part of a rural settlement was uncovered in the commune of Èze (Alpes-Maritimes). The remains uncovered reflect the evolution of this estate from the 1st century BC to the 6th century AD, punctuated by structural, functional and topographical transformations. These radical changes made by the site's inhabitants are evidence of a major transition within the estate. The example of a pond transformed into a structured stone basin is a significant example of these upheavals, which may have been the result of a change in activity. The anthropic excavation is organised around an exsurgence that supplies the depression with water. This would have been trampled and used as a drinking trough for livestock during the 3rd century AD, as evidenced by heavy parasitic pollution. In the 6th century AD, the occupants replaced the pond with a large pool made up of a belt of limestone blocks and served by a staircase. The hydraulic structure would no longer be used or accessible by animals. The new features were designed to provide clearer, healthier water. The furniture collected and the pollen spectrum identified in the hydromorphic fill suggest that tanning activities were carried out within the structure.

These observations could only be brought to light by combining the skills of field archaeologists and a geoarchaeologist with the analyses of specialists in palaeoparasitology and palynology on samples taken according to a protocol drawn up during the field phase. The interactions between these different players and the multidisciplinary approach to this waterhole from the field to the post-excavation stage will be highlighted in this paper.

Keywords: preventive archaeology, geoarchaeology, basins, ponds, palaeoparasitology.

Illustration

Basin built in the 6th century to replace the pond.

Credit : SANCA.

- 7 -
DETECTING AND UNDERSTANDING ARCHAEOLOGICAL STRUCTURES: DITCHES, TELLS, BARROWS AND HOUSES

Don’t ditch the ditches! Moats and ditches as geoarchaeological and archaeobotanical archives in northern Italian Bronze and Early Iron Ages.

Cristiano Nicosia, Paolo Bellintani, Andrea Cardarelli, Michele Cupitò, Silvia D’Aquino, Marta Dal Corso, Wieke De Neef, Giorgio Piazzalunga, Federico Polisca, Paola Salzani, Vincenzo Tiné, Elena Zaffaina

This contribution presents a multidisciplinary study of sedimentary fill of moats and ditches from three crucial settlements of the northern Italian Bronze Age and Early Iron Age: Fondo Paviani, Villamarzana, and Frattesina.

Northern Italian protohistoric settlements located in the alluvial plain of the Po Valley, commonly feature hydraulic infrastructures. Especially from the Middle Bronze Age (1650-1350 BC), the typical settlements, known as Terramare, included moats and earthen ramparts surrounding the dwelling area to ensure protection and water management (i.e., Fondo Paviani). After the collapse of the Terramare culture, moats and ditches continued to be constructed also in newly founded centres of the Final Bronze Age-Early Iron Age (i.e., Villamarzana, Frattesina). The functions of these hydraulic structures, sometimes also internal to the settlement, are likely linked to the control of floods, the division of the settlements into blocks and water transport in connection to major rivers.

Given the close connection between these infrastructures and residential and craft areas, they were an integral part of daily life at the sites. From a geoarchaeological perspective, they provide traps that incorporate anthropogenic sediments from daily activities and reflect local environmental conditions (e.g., running or standing water, sediment washout, hygrophilous vegetation etc.). Furthermore, moats and ditches can become waterlogged basins in which organic-rich sediments accumulate during the site occupation and after abandonment, providing us with crucial paleoenvironmental archives at least in part coeval to the sites.

We will compare three case studies where the fill of these hydraulic features was carefully excavated, described, and sampled for geoarchaeological and archaeobotanical analyses. Sedimentological and micromorphological analysis were applied to reconstruct the sedimentation processes and human activities. In the case of intra-site ditches, like in Frattesina, these analyses allowed us to solve the long-debated question of whether they were usually filled with water or just used for trash disposal. The continuous series of flooding events identified in the ditch fill suggests that their main function was to manage periodic floods. Archaeobotanical analyses (pollen, NPP, phytoliths, charcoal, macro remains) aim at obtaining precise snapshots of local or regional palaeoenvironmental significance about land use around the sites. Furthermore, pollen data, supported by radiocarbon dating and sedimentary evidence, are used as a valuable tool to infer seasonality of flood events and changes in the local environment and in the regional vegetation, according to the temporal resolution of the stratigraphic record.

Keywords: Bronze Age, Early Iron Age, Northern Italy, moat, ditch, palaeoenvironment, geoarchaeology, micromorphology, archaeobotany, sedimentology

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Illustration

The large ditch of the Villamarzana site in course of excavation.

Credit: Cristiano Nicosia, institution Dipartimento di Geoscienze, Università di Padova (Italy).

Erosion, biological activity, development, filling in. Complementary archaeological and geomorphological approaches to ditch dynamics.

Gérard Fercoq Du Leslay, Kai Fechner, Frédéric Broes (coll.), Dominique Bosquet (coll.)

Stratigraphic and pedological features are central to understanding the succession and nature of events or activities directly associated with the history of a ditch. This concerns two aspects in particular:

- Distinguishing erosion, stabilisation and sealing phenomena.
- Identifying signs of human disturbance or abandoned structures (excavation, installation of posts, installation of a casing system, etc.).

In ditches with a thick and complex backfill, the archaeological interpretation of the structures is largely dependent on a good reading of the stratigraphy and a correct determination of the nature of the strata and anomalies observed. In the absence of an ad hoc reading, the risk of misinterpretation and unsuitable sampling for analysis is high in this type of context.

Lateran quadrangular enclosure ditches excavated at Ribemont-sur-Ancre (Somme, France) and Hannut (Province of Liège, Belgium), compared with data from neighbouring sites, reveal multi-phase sequences with singular interpretations. Based on these examples, the authors will attempt to show how research guided by an archaeologist-geomorphologist team has succeeded in developing an interpretation that can contribute to the development of the chronology and interpretation of these sites. The results were discussed collectively, compared and confronted with data from comparable contexts, as well as with the results of experiments. The limited financial resources allocated to these studies meant that choices had to be made. These choices, guided by the issues specific to each site studied, were intended to determine at the field phase which analyses were best suited to validating the hypotheses adopted, which consequently conditioned the nature of the sampling.

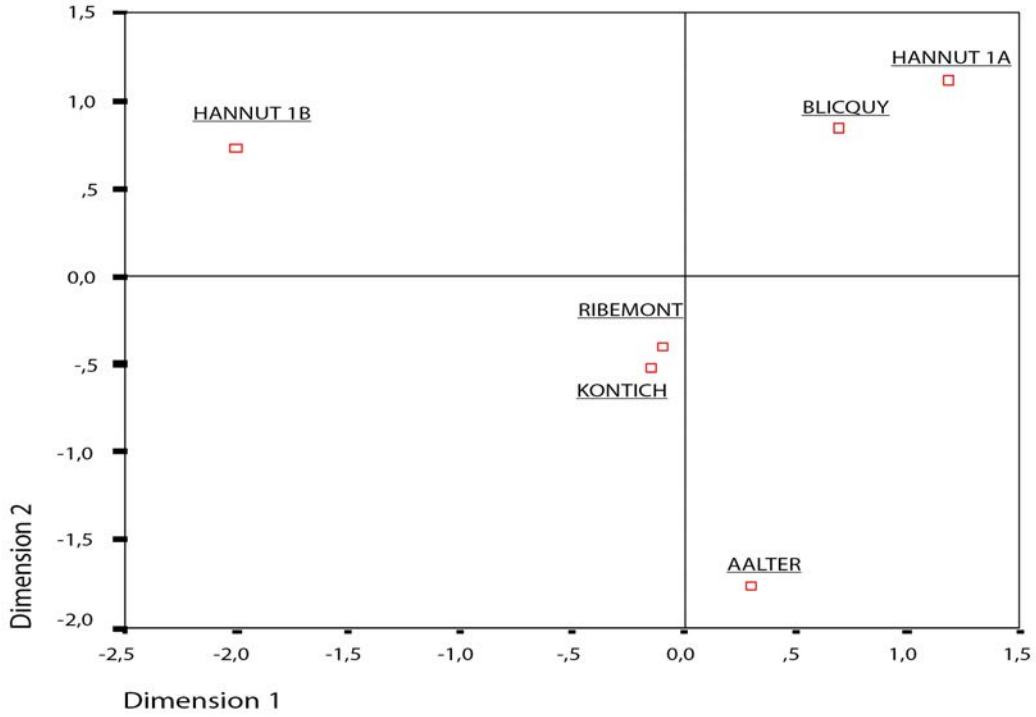
Through these examples, the authors wish to draw the attention of those in charge of an operation to the value of such an approach, necessarily in relation to the issues developed on each site. They also wish to make archaeologists aware of the value of detailed study of fossil structures as part of the interpretation of the site they are exploring.

Keywords: Belgium, Northern France, La Tène, ditches, erosion, filling, development, archaeology, geomorphology, loess.

Illustration

Multivariate analysis based on a systematic and detailed field study of pedological and sedimentary features observed in the cross-sections of enclosure ditches of Latenian quadrangular plans: the two phases of the Hannut ditch (A and B) compared with other enclosures.

Credit: Jean-Louis Slachmuylder, Kai Fechner.



A section through a longbarrow at Ottenburg (B).

Bart Vanmontfort, Karen Vancampenhout, Stefaan Dondeyne

"De Tomme" in Ottenburg (B) is a 120 m long and 4 m high earthen construction that fits the definition of a prehistoric longbarrow. Lacking reliable information on the age, function and construction techniques used, a section was made through the construction during the summer of 2013. The trench profiles exposed the complex interplay between strata related to the phasing of the construction and subsequent pedologenesis. This in turn resulted in animated discussions on the processes responsible for differences in texture, colour and inclusions and their meaning in understanding the biography of the monument.

Keywords: longbarrow, construction, degradation, pedogenesis.

The contribution of geoarchaeology to the study of mottes castrales in Flanders, the example of Singelberg.

Frédéric Cruz, Luc Allemeersch, Philippe De Smedt, Davy Herremans, Pieter Laloo, Joachim Rozek, Annelies Storme, Jeroen Verhegge, Ruben Vergauwe

With the advent of preventive archaeology in Flanders in the 2000s, Flemish archaeological research has undergone a major transformation. These changes have resulted in the more regular presence of numerous specialists throughout the studies. Geologists, soil scientists and, to a lesser extent, geophysicists are employed as part of the diagnostic work, to provide information about archaeological potential and its conservation. Over time, effective prospecting methods have been developed.

The techniques used are non-destructive (geophysical surveys) or minimally invasive (manual or mechanised drilling and soil pits). These techniques make it possible to obtain a large amount of information about an archaeological site at low cost. At the same time, they quickly provide significant information on the paleoenvironmental potential, in particular the presence of natural or man-made structures that may contain a sedimentary record.

With this in mind, a research programme (synthese onderzoek) on around twenty motte castrales in Flanders was submitted in 2020 to the Flemish Regional Heritage Agency (agentschap Onrorend Erfgoed). It aims to take an innovative approach to the traditional archaeological study of medieval motte castrale by integrating their natural context using geoarchaeological surveys. In this presentation, we aim to illustrate the contribution that non-invasive palaeoenvironmental prospecting can make to an archaeological site, using the Singelberg as an example.

Located in the municipality of Beven in East Flanders, the Singelberg is a motte castrale that was excavated in the 1970s. Its construction dates back to the 12th century. It was built near the Scheldt to protect the region from Viking attacks. The site was occupied until the 16th century, with various phases of construction and development. In the archives, the original name Beverenbroeck is a wetland (marshy) toponym, whereas today it is located on the edge of the Flemish maritime plain.

Initially, a cartographic study (pedological, geological, old maps, etc.) was carried out in addition to an analysis of the LiDAR data available in the region. Next, an electromagnetic survey revealed various structures (platforms, ditches, etc.). The site was then photographed using a drone. Based on microtopography and maps of electrical and magnetic anomalies, boreholes were drilled. The fossilised structures were sampled for palynological content analysis.

Keywords: motte-and-bailey castle, sedimentology, geophysics, palynology.

Crossed views on occupation of a neolithic building in the Southern Caucasus: field observations and micromorphological study at Mentesh Tepe (Azerbaijan).

Mathias Bellat, Emmanuel Baudouin, Cécilia Cammas

Recent studies in the Southern Caucasus have been made on neolithic structures architecture with a macroscopic (Baudouin, 2019; Nishiaki *et al.*, 2021; Badalyan *et al.*, 2022) or microscopic focus (Bellat *et al.*, 2023). Despite meticulous description and recording of the structures while excavating, the infilling of these earthen neolithic structures often lead to many questions. In these buildings made of raw earth, it can be difficult to distinguish occupation levels, destruction levels, and infilling or sedimentation levels (Friesem *et al.*, 2011). Geoarchaeology seems a good answer to draw a full portrait by managing a multi-scalar approach (Fouache, 2010) essential for a good understanding of the structure and more broadly Neolithic culture organization. Cross perspectives between macroscopic and microscopic approaches are giving new insights into the invisible specificity of earthen architecture. By treating this question with soil science methodology, and more specifically micromorphology, we were able to bright to light the uses and succession of layers inside building 1031 of Mentesh Tepe (Azerbaijan). Overall, we proposed an interpretation for the different occupation and destruction phases of the structure.

The site of Mentesh Tepe in the Middle Kura Valley (Azerbaijan) shows a Neolithic occupation dated between 7 750 and 7 600 cal. B.P. (Lyonnet *et al.*, 2017). The neolithic phase is characterized by circular earthen buildings presenting elevation modules. Building 1031 is an exception with a half-embedded structure and: its size, post-holes presence, in situ grinding stone, and layered infilling. In order to understand the stratigraphic succession inside structure 1031 three micromorphological, samples have been taken in 2015. The description of pedo-features combined with the anthropic elements (sherds, mudbrick, flint) put in evidence multiple distinctive phases of uses, repairs, and finally destruction of the building.

This study aims to show that the soil micromorphology approach, can reveal stratigraphic layers succession with anthropic or natural phenomena indistinguishable during excavation. This feedback on the preliminary results shows the interest and potential of such a cross-approach between archaeology and geoarchaeology.

Keywords : South Caucasus, Neolithic, soils, micromorphology, architecture, occupation layers, half-embedded structures

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Illustration

Building 1031 with its buried semicircular structure and millstone in situ to the south.

Credit: Boyuk Kesik Mission.

The sheep war: taphonomy of military trenches from the Spanish Civil War in a low mountain context.

POSTER

Julien Blanco, Manex Arrastoa Mendizabal, Karlos Almorza Arrieta, Javier Buces Cabello

Following the fighting of August-September 1936, the military trenches protecting access to the Basque town of San Sebastian suffered different fates, ranging from being filled in more or less immediately to being abandoned as they stood. These differences in treatment have conditioned the mark that these defensive structures have left on the landscape, in an area that has remained resolutely rural and where the concrete memories of this conflict have gradually disappeared. The archaeological operations carried out since 2013 are designed to question this memory and recover the materiality linked to this bellicose episode. They are also an opportunity to look into the future of these trenches, with the support of numerous aerial photography campaigns enabling regular monitoring of the area since 1945. The test pits provide an insight into the rate at which the trenches fill up naturally after abandonment in the face of specific environmental factors, or the effects of sediment infiltration according to the different types of filling, in some cases enabling a reading to be made on the ground almost 80 years after early sealing. Contemporary archaeology provides an opportunity to experiment with the impact of specific parameters on the taphonomy of hollow structures.

Keywords : Late modern period, taphonomy, colmatage, en creux, landscape.

Illustration

Archaeological survey of an abandoned defensive trench from 1936, visible after clearing, overlooking the Aiztondo valley from Mount Otarrazabal.

Credit: S.C. Aranzadi, 2020.

New perspectives on peri-urban areas in Pompeii (Italy): an archaeological and micromorphological approach to the Nocera road.

POSTER

Marie-Caroline Charbonnier, Cecilia Cammas, Pascal Neaud

The French excavations carried out in the peri-urban and funerary area of Porta Nocera in Pompeii (Italy) shed new light on the formation processes of the archaeological layers of this city, whose soil was fossilised by the eruption of Mount Vesuvius (Porta Nocera excavation, W. Van Adringa dir.). In the area of the Porta Nocera necropolis, to the south-east of the town, the funerary monuments are located beside the road leading to the town of Nocera. Our study has several aims. Firstly, to understand the nature of the levels associated with passage and traffic in order to characterise the way in which the road was laid out and operated. This aspect also makes it possible to assess its durability within the peri-urban area. On the scale of the funerary occupation, the study reveals the particular features of this traffic space, in terms of both form and function, which shed light on the dynamics of the development of the road in relation to the funerary monuments that line it. The poster will present the results of the archaeological and micromorphological analyses carried out on this site as part of the geoarchaeological and micromorphological research into the construction methods and evolution over time of traffic routes.

Keywords: Roman antiquity, Italy, Pompeii, road, track, funerary archaeology, necropolis, formation process, micromorphology.

Illustration

Orthophotographic view of the Nocera road crossing the necropolis (Porta Nocera, Pompeii).

Credit: Johannes Laiho, William Van Andringa.

Antique houses and yards in Atlantic and Mediterranean climates: impact on field characteristics and on chemical field tests.

POSTER

Kai Fechner, Frédéric Broes, Viviane Clavel, François Malrain (coll.), Elsa Frangin (coll.), Mathieu Le Bailly (coll.)

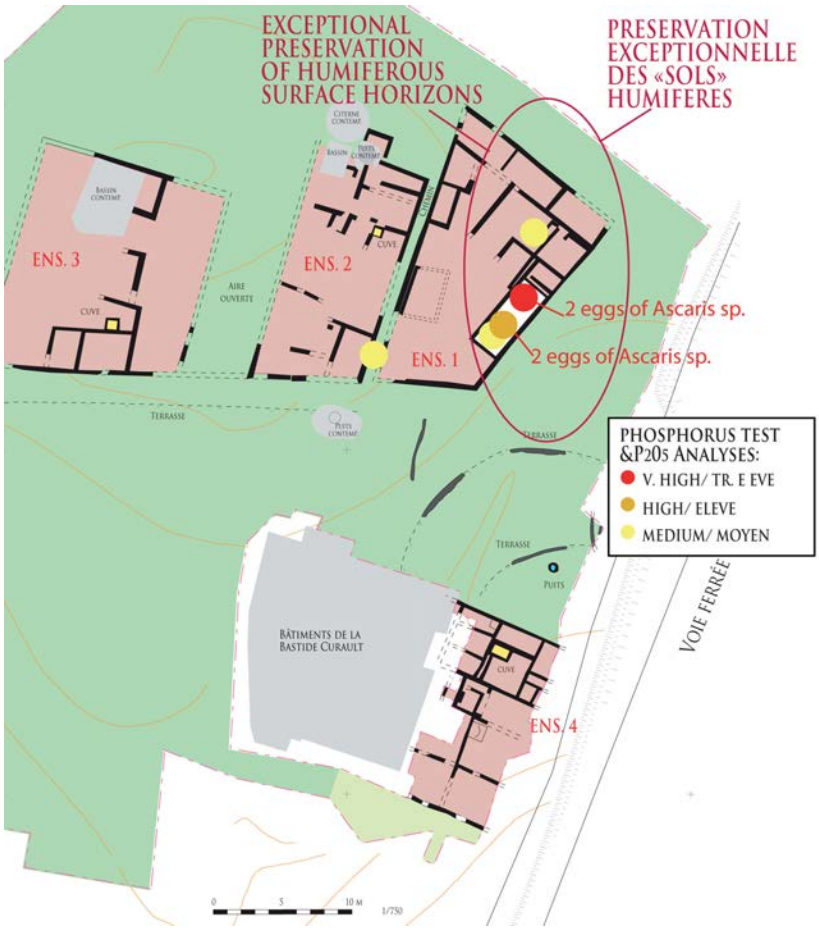
The soil scientist's contribution to the interpretation of the surface activities in former houses, yards and enclosures often implies the mapping of chemical elements as phosphorus and cations. In recent years this has been promoted over large parts of France, which is a positive development. However, many sites that provide ideal preservation conditions are omitted, others that are less ideal are sometimes concerned and financed for such studies. To avoid this, it is useful to determine soil and preservation conditions in the field as soon as possible, during diagnostic surveys or at the beginning of the larger excavation. Field observations of erosion of the natural soils horizons, impact of overlying sediments and horizons on the house surface, bioturbation, impact of water table (Devos *et al.*, 2011) and simple chemical field tests are routine steps. They favour or avoid selective or extensive sampling, testing and further analyses as laboratory analyses of mineral chemistry, paleoparasitology, XRF, molecular biochemistry, phytolith analyses. Finally, the impact of underlying material (e.g. limestone) and the region's climatic conditions can be checked and plays an immense role in the preservation and interpretation of the chemical signals.

These differences are illustrated by results obtained in four exemplary antique houses and yards in Atlantic as opposed to Mediterranean climates, also taking into account literature on experimental sites as Butser Iron Age Farm.

Keywords : Roman Empire, France, house, soil science, phosphate, cations, mapping, field observations, parasites, climate.

Bibliography

Devos, Y., Fechner, K., Mikkelsen, J.H. (2011). The application of phosphorus cartography to archaeological structures : the development of a protocol. In K. Fechner, Y. Devos, M. Leopold, J. Völkel (eds.), *Archaeology, soil- and life sciences applied to enclosures and fields. First volume of the proceedings of the session 'From microprobe to spatial analysis – Enclosed and buried surfaces as key sources in Archaeology and Pedology'. European Association of Archaeologists, 12th Annual Meeting, Krakow, 2006* (p. 9-28). British Archaeological Reports. International Series.



Illustration

Part of the excavation plan of the Late Roman phases of the villa the Mougins (Alpes-Maritimes, France) showing a strong enrichment in phosphorus and some parasite eggs: possible stabling area.

According to Elsa Frangin, completed by Kai Fechner.

A joined venture: two Early Neolithic houses (Mosel valley, France/Luxembourg) re-interpreted by chemical field tests and archaeobotany.

POSTER

Kai Fechner, Laura Berrio, Julian Wiethold, Marie-Pierre Petitdidier (coll.)

The internal functional subdivision of some early Neolithic longhouses of the Bandkeramik culture has benefited from the results based on the observations of the sediment, chemical field tests and the sieving of the content of the post-holes, looking for carbonized plant remains. Based on the experimental work of Peter Reynolds (1995), we use the top part of the post-holes as a source of information about activities that took place in their immediate neighbourhood. In some cases, both sedimentary and botanical approaches have revealed clear differences in the results according to the part of the house, as well as a good contrast with the results outside de building.

Taking into account regional and architectural specificities of the studied houses, more precise and additional internal functional subdivisions are proposed, as well as new hypotheses about specific activities related to them. We propose to compare the two used proxies with the archaeological hypotheses about functional subdivisions of early Neolithic houses that are based on other approaches.

Keywords: Early Neolithic, Luxembourg, North-eastern France, posthole, architecture, longhouse, soil science, phosphorus, carpology, anthracology

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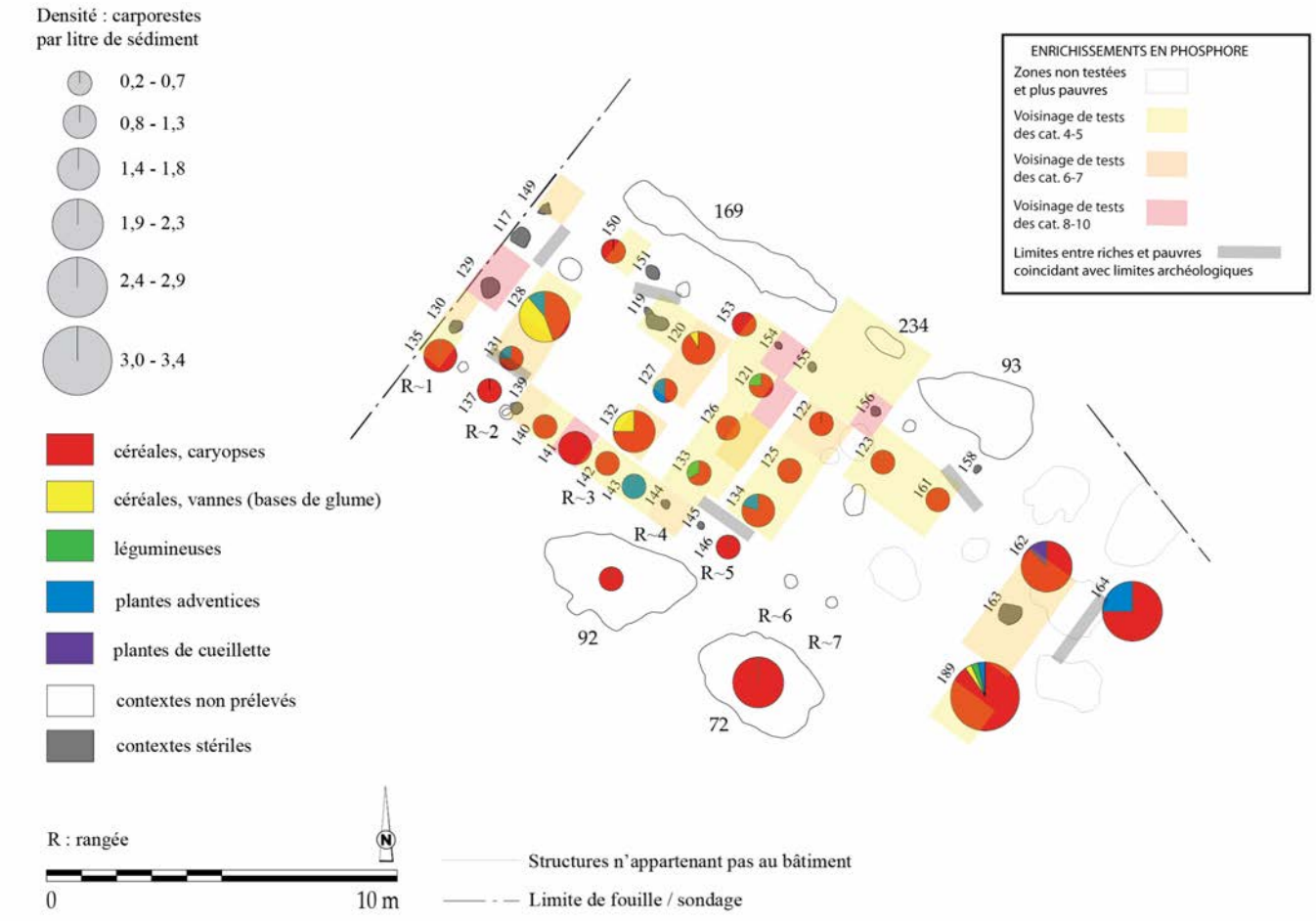
Bibliography

Reynolds, P. (1995). Life and death of a post-hole. In E. Shepherd (dir.), *Interpreting Stratigraphy 5 : Proceedings of a Conference held at Norwich Castle Museum on 16th June 1994* (p. 20-25). The Norfolk Archaeological Unit.

Illustration

Ennery (Moselle, France), building M1. First attempt to superimpose field test data and carpological data in a building of "rubané mosellan".

Credit : L. Berrio, K. Fechner.



- 8 -
DETECTING AND UNDERSTANDING ARCHAEOLOGICAL STRUCTURES : FIRE

From experimental to archaeological reality: the contribution of sediment analysis to identifying the function of combustion structures on silty to clayey soils.

Carole Deflorenne, Frédéric Broes, Kai Fechner, Sylviane Mathieu, Sophie Challe (coll.), Sylvie de Longueville (coll.), Sonja Willems (coll.), Viviane Clavel (coll.)

Combustion structures (hearths or ovens) pose numerous problems of interpretation in terms of how they functioned, how long they were used, and even their purpose. They suffer from the limitations of the various archaeological approaches used in the field, which are often limited to morphotypes.

Experimentation with targeted productions and the geo-archaeological approaches applied to them provide a number of identification criteria to guide the understanding of archaeological structures located on non-limestone silty or clayey soils in Wallonia and northern France. This comparison with a number of archaeological realities, particularly in an artisanal context, has led to the proposal of a reference system of soil features likely to facilitate functional interpretation.

[Translated with www.DeepL.com/Translator]

Keywords: Belgium, Northern France, kilns, hearth, artisanry, culinary, colouring, hardness, experimentation.

Illustration

Zenithal view of the early medieval potter's kiln at Quévy (Hainaut province, Belgium).

Credit: Véronique Danese, AWAP.

A multi-method toolkit to study burnt archaeological daub.

Jana Anvari, Astrid Röpke, Tobias Kienlin

This project brings together geoarchaeological and traditional archaeological methods to enable a more comprehensive social and environmental interpretation of the building material daub. Our current work is a methodological pilot study that – by bringing together and tweaking existing methodological approaches – aims to establish a multi-method tool kit as a new standard in the archaeological research on burnt daub. Daub, although a major component of prehistoric sites in Europe and other regions, is an archaeological material that is not routinely studied and if it is studied, research has often focused on individual aspects of the material, such as shape, sediment or plant components. Our project seeks to create a dense database on various aspects of daub, which can be cross-referenced with each other and with spatial and chronological information from each site to answer research questions as to e.g. change in building technologies over time or differences between various areas (buildings, neighbourhoods) of the same site. Using material from Neolithic and Bronze Age sites in southeast Europe as case studies, we are in the process of developing recommendations for a best-practice work flow in the archaeology study of daub, combining traditional archaeological methods such as shape typology, drawing and photography with 3D documentation and with geoarchaeological and archaeobotanical studies of the sediment and preserved plant remains.

Keywords: southeast Europe, daub, geoarchaeology, archaeobotany, architecture analysise.

Illustration

Fragment of daub from Vrbjanska Čuka with imprint and preserved husks of an ear of wheat.

Credit: Jana Anvari.

Recognising charcoal pits, funeral pyres and Polynesian ovens: from the risk of confusion to clear oppositions.

POSTER

Kai Fechner, Sylvie Coubray, Véronique Danese, Sophie Oudry

This poster presents recent results enabling us to distinguish between several types of charcoal-rich structures that are sometimes confused with one another, especially during the diagnostic phase. The information is based on field and laboratory pedological, anthracological, anthropological and experimental data. It covers around ten examples from various protohistoric and historical contexts in northern and central France, Belgium and Luxembourg, on sandy, silty and clayey soils, most often non-calcareous. In addition to the results for these sites, the aim is to propose criteria for field distinctions and the choice of relevant analyses.

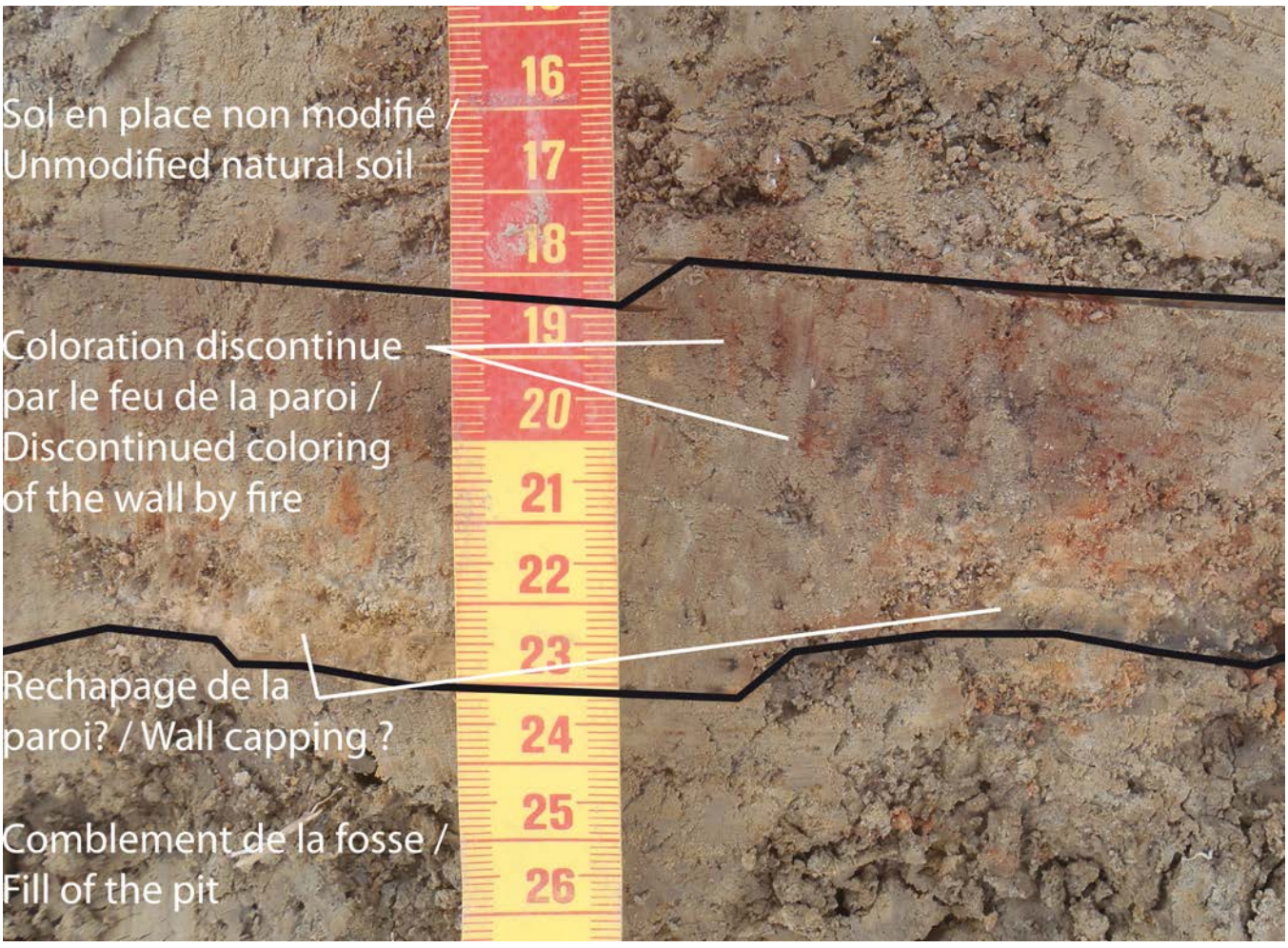
[Translated with www.DeepL.com/Translator]

Keywords: oven, charcoal burner, funeral pyre, Polynesian oven, rubefaction, melanisation, retreading, archaeopedology, anthracology, experimentation.

Illustration

Plan details of the wall of one of the Gallo-Roman coal pits at Dourges (Pas-de-Calais), confirmed by field pedology, micro-morphology and anthracology (responsible for the operation: T. Marcy).

Credit: K. Fechner, Inrap.



Reading combustion structures in a housing context: achievements and prospects.

POSTER

Gaëlle Bruley-Chabot, Kai Fechner

Combustion structures in the context of settlements most often correspond to remains used for cooking food or materials. Their excavation and study require both an archaeological understanding (morphological and stratigraphic recognition) and a pedological understanding (recognition of the alteration of the soil by fire).

The experience gained in the field, in the Paris Basin and occasionally abroad, through the excavation of a variety of combustion structures, coupled with typochronological research into bread ovens from the early Middle Ages, has enabled us to forge a consistent frame of reference and develop systematic excavation and recording techniques. Recurrent exchanges with colleagues practising micromorphology and archaeomagnetism, as well as experimental attempts, have fuelled hypotheses relating to the functioning and recognition of markers caused by heating.

The aim of this presentation is to provide a common basis for describing the combustion structures most commonly found in the context of housing. The aim is to gain a better understanding of their general characteristics, prior to any more in-depth analysis or interpretation, and to enable better comparisons to be made. These characteristics respond to objective criteria of heat distribution in spaces that are more or less closed or oxidised, reached or not by embers, whether during construction, pre-heating or the main combustion phase(s). This applies to food production or processing activities as well as to activities with which they may be confused within a dwelling (e.g. smithy, etc.). Work pits and their multiple levels of discharge (use, refurbishment, destruction, abandonment) are also important sources of information.

In order to demonstrate the relevance of the approach, two sets of cases will be developed and compared in particular: kilns in early medieval habitats and Gallo-Roman soils in the Paris Basin, compared with specific examples from other countries and sedimentary contexts. They illustrate the links that can be established between morphology and the phenomenon and distribution of soil alteration by heating (thickness, hardening, cracking, rubefaction or melanisation). The importance of controlling certain features at particular points (contact between sole and vault, working pit) and more in-depth methods will be particularly discussed, as will the role of repeated firing and the significance of dark, hardened firing crusts.

[Translated with www.DeepL.com/Translator]

Keywords: oven, culinary cooking, rubefaction, melanisation.

Illustration

Examples of rubbed and melanised soil cuttings (Croixrault-80, Meaux-77).

Credit: Gaëlle Bruley-Chabot, Inrap.

"Classic" slash-and-burn, a farming practice that is ignored but has a high archaeological profile.

POSTER

Clément Menbrivès, Michelle Elliott, Christophe Petit

In the grey literature, a number of events are recorded as "burnt windfalls", "grubbing" or "deforestation". The majority of these 'off-site' events take the form of irregular traces of ruby and sometimes carbonaceous sediments, which correspond to tree stumps burnt in situ and possibly testify to anthropogenic deforestation. However, the way in which these remains were formed is almost never specified, nor is their anthropogenic origin proven.

However, natural surface vegetation fires, like grubbing - a technique for preparing a temporary field in a wooded area, using a running fire that does not involve stumping - only exceptionally leave physical evidence of their passage. Modern agronomic treatises, on the other hand, often refer to a pyrotechnic technique designed to prepare land for agro-pastoral use. This technique, known as "ecobuage" in the "classical" sense (Sigaut, 1975), involves extracting the surface soil in the form of clods or slabs, which, along with their adjacent vegetation, are used to build veritable furnaces. The burning of the vegetation, but above all the soil, made possible by the elevated architecture, is designed at the same time to eliminate obstacles to cultivation and achieve temporary physico-chemical improvement. This technique is particularly relevant in clay soils and environments such as moors, meadows and pastures. Because it is carried out "under cover", the ecoburning process involves the production of substantial amounts of heating residue.

The results of the study of "rubbed" layers in different contexts (Chalain lake, Troyes alluvial plain, Limagne basin, Saint-Gond marshes) will be briefly presented. The hypothesis of fires affecting root systems does not seem very relevant compared with that of residues of earthen elements fired in furnaces. Furthermore, it seems that depending on the initial soil-sedimentary context (at the time of the event) and the post-depositional context, these deposits lead to the formation of relatively varied facies. The possibility that this type of remains could be confused with pedogenetic redox features has also been raised.

The absence of obvious traces of development, their erratic and irregular nature, and the absence of the microscopic features typical of cultivated palaeosols complicate and restrict our understanding of these structures, or even their recording in the field. Nevertheless, their recognition is essential, as these traces are among the all too rare direct evidence of agricultural practices, yet their archaeological visibility is far from negligible.

[Translated with www.DeepL.com/Translator]

Keywords: Middle Ages, Neolithic, geoarchaeology, palaeoenvironment, palaeosol, rubefaction, ecobuage, essartage, brûlis, temporary agriculture.

Bibliography

Sigaut, F. (1975). *L'agriculture et le feu. Rôle et place du feu dans les techniques de préparation du champ de l'ancienne agriculture européenne.* Paris, La Haye : École des Hautes Études en Sciences Sociales et Mouton & Co.

Illustration

Ochre-brown to rusty soil-sedimentary unit embedded in blackish silty-clay colluvium with greenish features, on the edge of the Chalain lake (Marigny, Jura). Geoarchaeological analyses (total and trace elements, mineralogy, micromorphology, magnetic susceptibility and colourimetry) show that it results from the heating of native sediments, with redoximorphic features superimposed. It is interpreted as the remains of an ecoburial furnace, chronologically dated by radiocarbon to around 900-1000 cal. AD.

Credit: Christophe Petit, Clément Menbrivès.

- 9 -
NEW INSTRUMENTS FOR FIELD WORK AND RECORDING

Assessing and characterising archaeological deposits: cross-referencing stratigraphic and geotechnical readings in the field.

Amélie Laurent-Dehecq, Mélanie Fondrillon

For the last fifteen years or so, in the Centre Val-de-Loire region, a cross-analysis has been carried out during preventive operations between the macroscopic observations of archaeologists and the measurement of the compactness of layers by a specialist. The aim is to assess the thickness of the archaeological deposit and to characterise it in detail, particularly when technical and/or financial conditions make it impossible to study the entire deposit. The complementary method to field observations consists of carrying out geotechnical soundings using a light dynamic penetrometer (PANDA®). These are first carried out at the edge of the cut in order to calibrate the in situ measurements, by comparing the descriptions of the archaeological layers with the measurements of peak resistance in MPa (pentetrogram). Secondly, PANDA® boreholes were positioned in areas where additional information was needed to complement the field observations. The data is interpreted using calibration, initial hypotheses and a regional archaeo-mechanical reference. The stratigraphic reading scale used by the archaeologist and the specialist is comparable, ranging from centimetric (US) to decimetric (sequence), depending on the problem. The features specific to the functional interpretation of the layers (grain size, constituents, etc.) are reflected, in some cases, by a specific signature of the penetrogram.

Examples will be presented according to the problems and constraints encountered by archaeologists. In an urban environment, this cross-sectional approach makes it possible to estimate the total thickness of the stratification of a site when mechanical test pits cannot reach the substrate for technical reasons. It can also be used to make assumptions about the functional interpretation of stratigraphic layers. The method is also used to study specific constrained contexts such as cellars or shafts. Ultimately, it is a decision-making tool that can be used to commit the appropriate technical resources to study the remains during an operation or in anticipation of a future operation, in the case of evaluation during a diagnostic followed by an excavation.

[Translated with www.DeepL.com/Translator]

Keywords: soil characterisation, assessment of archaeological potential, stratigraphy, geotechnics, field approach.

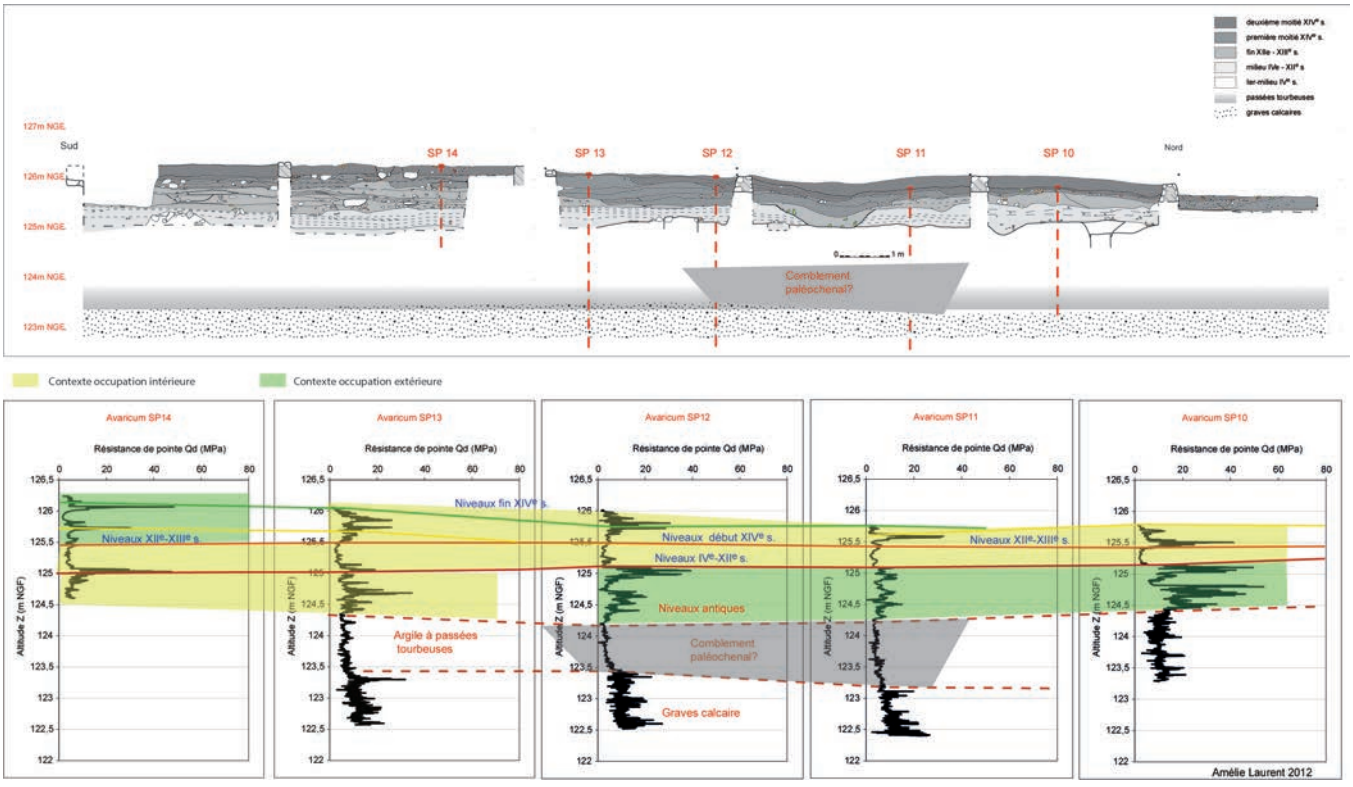
Bibliography

Dehecq, A. (2018). Methods of assessment and characterization for urban stratification at Tours and Bourges (France) and the question of early medieval dark earth deposits. *Post-Classical Archaeologies*, *8*, 31-60.

Illustration

Stratigraphic and geotechnical analysis of a section on the ZAC Avaricum site, Bourges (France).

Credit: Bourges Plus preventive archaeology service.



Geophysical approaches to pedo-sedimentary studies in archaeology.

Jeroen Verhegge, Gastòn Mendoza Veirana, Wim Cornelis, Philippe Crombé, Hana Grison, Eelco **Rensink, Jan-Willem De Kort, Michał Pisz, Michał** Jakubczak, Philippe De Smedt

One of the main challenges in geophysical prospection in archaeology is the unpredictability of the geophysical responses. This prediction comes down to resolving the question if an archaeological feature will render an observable geophysical contrast within its pedological and/or sedimentary context with a given geophysical method. One way to approach this problem is through forward modelling, whereby the response of specific instruments over representative synthetic models of archaeological features and soils is simulated.

However, parametrizing these models is not a straightforward task. While the geometry of potential archaeological features and soils is static, and can often be assessed through prior archaeological information, addressing the geophysical properties of features' backfills and soil horizons remains challenging. Furthermore, many of these properties, such as electrical conductivity or dielectric permittivity, are dynamic because they are influenced primarily by soil moisture content, which is variable.

To overcome these challenges, the *Working the land, Searching the soil* project is developing field strategies for in situ geophysical data collection and soil sampling, which ought to be feasible in archaeological field practice, to determine and predict geophysical properties of a wide range of archaeological and pedological targets. Aside from measuring geophysical properties of excavated sections, they are also sampled to optimize pedophysical models. Such models allow converting commonly analyzed soil properties (e.g. soil texture) to geophysical properties. Finally, long-term geophysical monitoring using soil moisture and electromagnetic sensors, installed in archaeological and natural soil sequences, allows to assess the impact of the dynamic soil properties on geophysical responses.

This approach allows forward modelling of archaeological features and soils to evaluate their detectability with a wide array of geophysical instruments through simulation, thereby optimizing prospection strategies. This provides a more unbiased and quantitative assessment than expert consulting, currently the main way of strategizing geophysical prospection.

The results of this development will be demonstrated through three archaeological and (paleo-)pedological case studies from the European lowlands sand belt. In Lommel (BE), mapping strategies are developed for a Weichselian late-glacial marker horizon, the Usselo paleosol, which provides potential contexts for wellpreserved Final Palaeolithic Federmesser sites. In Valthe (NL), a leached soil feature of a possible stone extraction pit, alongside two Dolmen, is investigated to develop prospection strategies for the subtle traces of Neolithic Funnelbeaker land use. In Radojewice (Poland), a trapezoidal longhouse of the Neolithic Brześć Kujawski culture is studied to explain underwhelming magnetometer and electromagnetic induction survey results remaining in contradiction to more satisfying, spatially complex contrasts in remote sensing, ground penetrating radar and electrical resistance survey.

Keywords: archaeological prospection, pedophysical modelling, geophysical forward modelling, soil monitoring.

Geophysical tools in pedology: examples and considerations for soil mapping in archaeology..

Francois-Xavier Simon, Guillaume Hulin, Benjamin Fores, Julien Thiesson

Geophysics is a tool commonly used for soil mapping, whether in agronomy to map soil units at plot level or in pedology to characterise horizons using laboratory measurements of magnetic properties, for example. In archaeology, geophysics is used above all to detect structures (built and hollow) or to map palaeochannels when understanding fluvial dynamics. Some surveys enable us to observe phenomena linked either to pedological variations on the scale of the site, or to layers of sediment or levels linked to the occupation of the site.

While some geophysical methods are based on the detection of local disturbances (differential magnetic method, georadar), other methods focus more on the geophysical properties of the ground, such as electrical or electromagnetic (EM) methods. The former are the most widely used because they are more effective at detecting structures in most cases and have a high resolution. The latter, on the other hand, enable archaeological structures to be distinguished if there is sufficient contrast, but also enable variations in the properties of the surrounding soil to be discerned. They are therefore more interesting for mapping archaeological levels or soil variations. In fact, these two methods can be used to assess the electrical and magnetic properties (for EM), which vary according to the bedrock, pedogenesis, human activity and also the water and clay content of the soil.

Through the examples given, we will see that geophysical characterisation of these soils does not allow conclusions to be drawn about the origin of the elements mapped. It also requires invasive approaches and additional soil, pedological or micro-morphological analyses and observations. Similarly, as with the detection of structures, it is important to remain vigilant about the effectiveness and relevance of these methods in relation to the environments studied.

We will present examples of soil mapping and levels of occupation. We will attempt to distinguish the contexts that are favourable for their identification, as well as their geophysical signatures. The aim will be to assess the potential of this type of mapping for understanding sites and its relevance as a tool for reading soils.

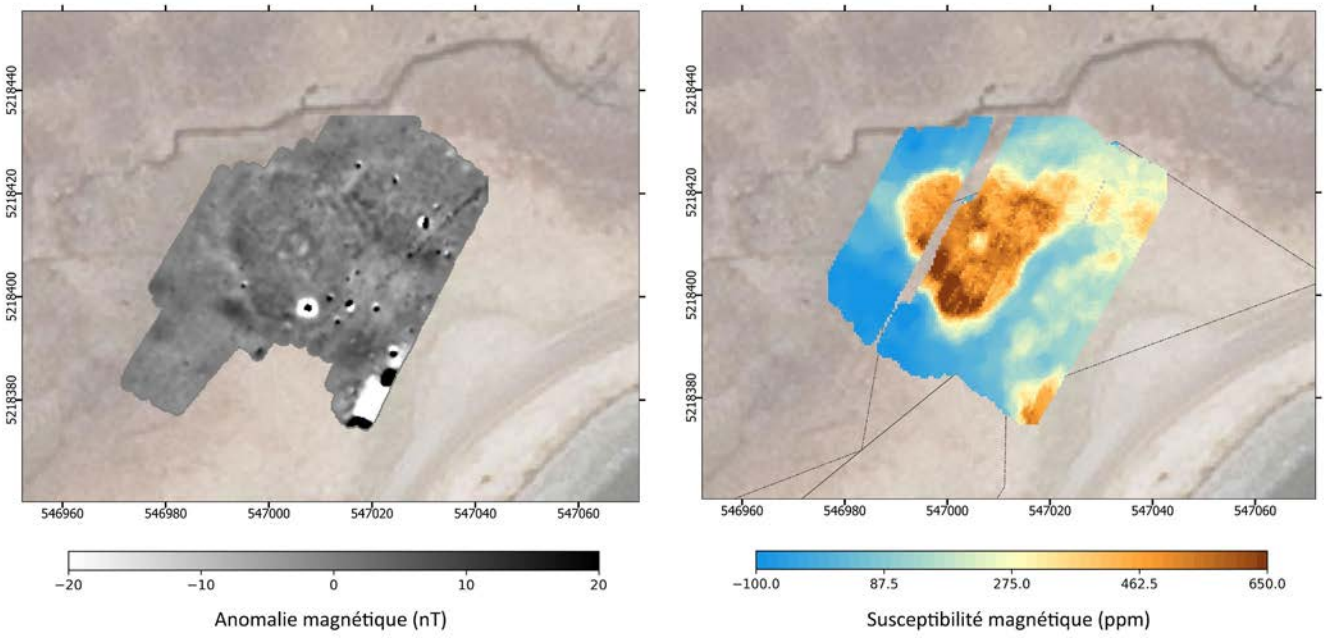
[Translated with www.DeepL.com/Translator]

Keywords: geophysics, spatial characterisation, detection, occupation space.

Illustration

Comparative map of magnetic prospecting data (left) and the electromagnetic signal proportional to magnetic susceptibility (right), at the Fond de l'Anse site (Saint-Pierre-et-Miquelon). The EM map makes it possible to identify a sedimentary level associated with a probable development, where the magnetic method is particularly sensitive to hollow structures.

Credit: BD ORTHO®, IGN, François-Xavier Simon, Benjamin Fores, 2023.



Using a sixth sense during a excavation: magnetic vision.

Francois Lévêque, Pablo Arias, Luc Laporte, Grégor Marchand, Mickaël Mestre, Martin Moucheron, Matar Ndiaye

During an excavation, the archaeological soil is divided into units on the basis of differences identifiable with our senses, mainly sight and touch (color, texture, mechanical resistance...). The use of hand sensors, which are easy to use, provides a sixth sense that allows us to observe variations in the magnetic properties of materials. Very significant differences can then be revealed whereas our natural senses detect only tenuous variations, which can pass unnoticed or be considered negligible.

These differences in magnetic properties may be related to materials of different origins or to mineralogical transformations involving changes in the state of iron in situ. These mineralogical transformations, described by E. Le Borgne in the 1950s-60s, are the result of pedogenetic processes or thermoalteration associated with the use of fire.

Three contexts of magnetic susceptibility and viscosity use will be presented:

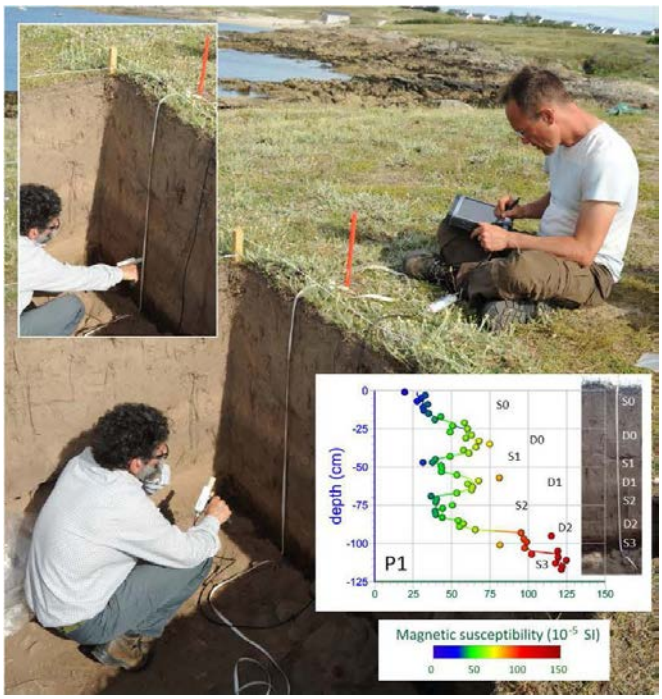
1. The boundaries of the ditch of the Fortuna Kappiri crowned mountain (Regina, French Guiana), dug in a ferralitic horizon and filled by this same material, are detectable only by variations in trowel strength. Magnetic mapping of the section perpendicular to the ditch axis reveals clear boundaries and undetected depositional sequences. The magnetic enhancements of these depositional sequences are markers of fire use to maintain this open space producing magnetite by thermoalteration of the goetite.
2. The geometry of the unbaked earthen structures of a "house of the dead" at the megalithic site of Thiekène Boussoura (Senegal) is confirmed by the differences in magnetic signature of the different units identified. The natural soil profile shows a magnetic enhancement at depth. Thus, the differences in signature of the archaeological units reflect a different depth of origin of the materials or a more distant origin.
3. The dunes cover of the Mesolithic site of Port-Neuf (Hoedic, Morbihan, France) shows slight variations in color with slightly darker zones. The magnetic survey shows magnetic depletions of these darker levels, as well as the present soil surface horizon, demonstrating the alternance of dune/paleosol sequences. In the Mesolithic levels characterized by more clayey levels under the dune bodies, a localized magnetic enhancement was observed without any convincing evidence of a hearth. However, this magnetic enhancement indicates the presence of thermoaltered materials, corresponding either to a magnetic phantom (sole of a hearth invisible to the eye), or to an emptying zone of a hearth.

Keywords: pedogenesis, (thermo)alteration, magnetic signature, deposition sequence.

Illustration

Magnetic susceptibility survey on the Mesolithic site of Port Neuf (Hoedic, France). Highlighting of depositional and pedogenic sequences, S3: Mesolithic paleosol, D2 to D0 dune deposits, S2 to S0: paleosols and present soil. Note the inversion of iron dynamics between the S3 paleosol developed on clayey-silty sediments, marked by magnetic enhancement, and the S2 to S0 paleosols and present-day soil, marked by magnetic depletion as a result of iron leaching on sandy substrate.

Credits: Pablo Arias (pictures), François Lévêque (curve and composition).



Sampling parameters for XRF analysis.

Arthur Laenger, Arnaud Martel, Aline Durand, Fabien Boucher

Ancient human activities leave behind chemical pollution in the soil on which they took place. By identifying this pollution on archaeological sites, it is possible to trace back the activities. A number of analytical techniques can be used to measure chemical elements in the soil. X-ray fluorescence spectrometry (XRF) is a chemical analysis technique that offers archaeologists many advantages over more conventional techniques. In addition to its application for the non-destructive study of various artefacts, it can also be used to study the soil at archaeological sites. The development of XRF in recent years has made this technique particularly popular with archaeologists. It does not require long and complex preparation phases, offers numerous results in a single analysis and is inexpensive. However, this analysis technique does require certain precautions to be taken during sampling. Sampling is a crucial process in the chemical study of soil in archaeology. Its parameters need to be considered in advance of the operations, especially as it is possible to carry out prospecting even before the excavation begins. However, poor sampling can lead to bias, which in turn can lead to errors in the results and subsequent interpretations. The aim of this presentation is to discuss the importance of sampling parameters in the chemical study of soils in archaeology, as well as the most commonly used protocols. Concrete examples of archaeological studies will be used to illustrate the advantages and disadvantages of the various settings.

Keywords: XRF, geochemistry, prospecting, excavation, sampling, gridding, soil.

Illustration

Sampling and preparation of samples for XRF analysis.

Credit: Roxanne Cesarini, Le Mans Université.

Detecting and characterising palaeochannels using mechanical and geotechnical core sampling. The contribution of research at Blois and Chambord (Loir-et-Cher, France).

POSTER

Amélie Laurent-Dehecq, Philippe Gardère, Eymeric Morin, Guillaume Hulin, Viviane Aubourg, Didier Josset, Simon Bryant

Between 2013 and 2018, two similar studies were carried out in the Cosson valley. The aim was to reconstruct the geomorphology of the palaeochannels detected by combining complementary readings of the subsoil from deep core drilling and PANDA® geotechnical surveys. PANDA® is a lightweight dynamic penetrometer used in archaeological contexts. A reference system has been set up for the Centre Val-de-Loire region.

The first study was carried out as part of a thematic survey of the major bed of the Loire to the west of the town of Blois (PCR *Blois ville et territoire ligérien depuis les premières installations humaines jusqu'à nos jours*). One of the aims was to verify the existence of a supposed ancient branch of the Loire crossing the alluvial plain, as relayed by Louis De La Saussaye in 1833, but not shown in old iconography. The first step was to carry out a geophysical survey, which revealed the existence of a large, more conductive natural structure. At the same time, transects alternating between core sampling and PANDA® drilling were carried out in order to clarify the local geomorphological characteristics and address the problem.

The second study was carried out during preventive excavations in the gardens of the Château de Chambord. Here, the Cosson was channelled to create gardens in a marshy area in the 16th century. An archaeological survey, a study of old plans and a geophysical survey revealed palaeochannels beneath the gardens. A geomorphological study to complement the excavation was carried out using the same approach as in Blois.

Dialogue between the geomorphologists and the archaeologist specialising in PANDA® was essential in these two cases in order to address various points:

1. Establishment of an intervention strategy for siting the core and geotechnical test pits, based on knowledge of the site and the technical and financial constraints of the operations.
2. Cross-reading to characterise the pedo-sedimentary features of the substrate and palaeochannel fillings on the basis of point data. Calibration of PANDA® measurements. Restitution of the geomorphological profile. Sampling for laboratory analysis (dating, sedimentology).
3. Feedback on experiences, advantages and disadvantages of analyses.

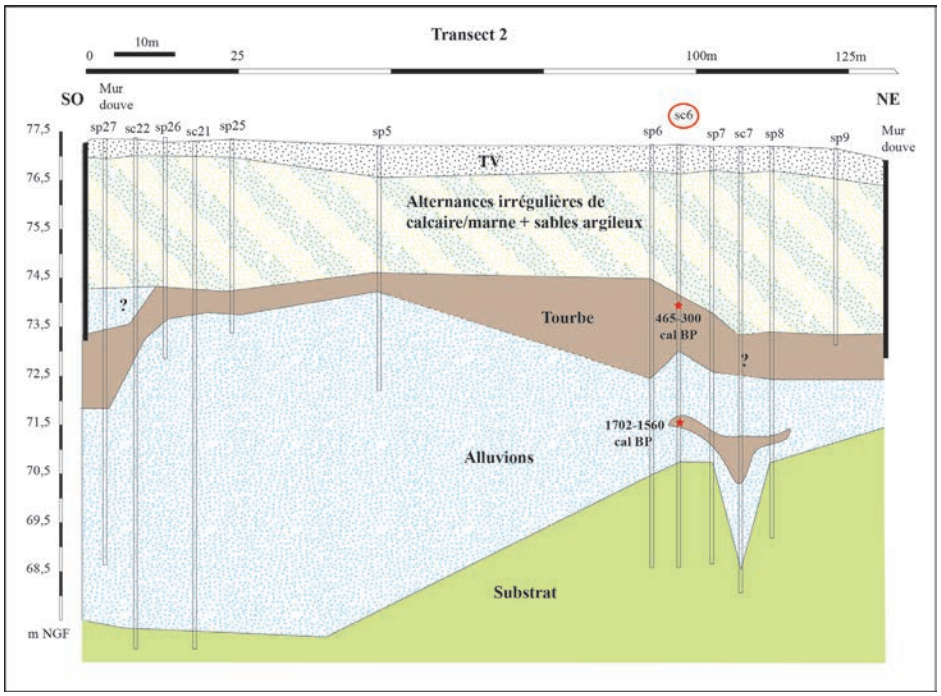
[Translated with www.DeepL.com/Translator]

Keywords: palaeoenvironment, alluvium, geophysical prospecting, core drilling, PANDA®, borehole, Loire basin.

Illustration

Geometry of the deposits in transect 2 in the gardens of the Château de Chambord (France), based on core sampling (sc) and penetrometer sampling (sp).

Credit: P. Gardère (Inrap), Laurent-Dehecq (CD45).



Painful but well-founded choices: complete excavation, pedological features and selection of the first analyses of a medieval motte at Ecoust-Saint-Mein.

POSTER

Thierry Marcy, Kai Fechner, Pascal Verdin (coll.)

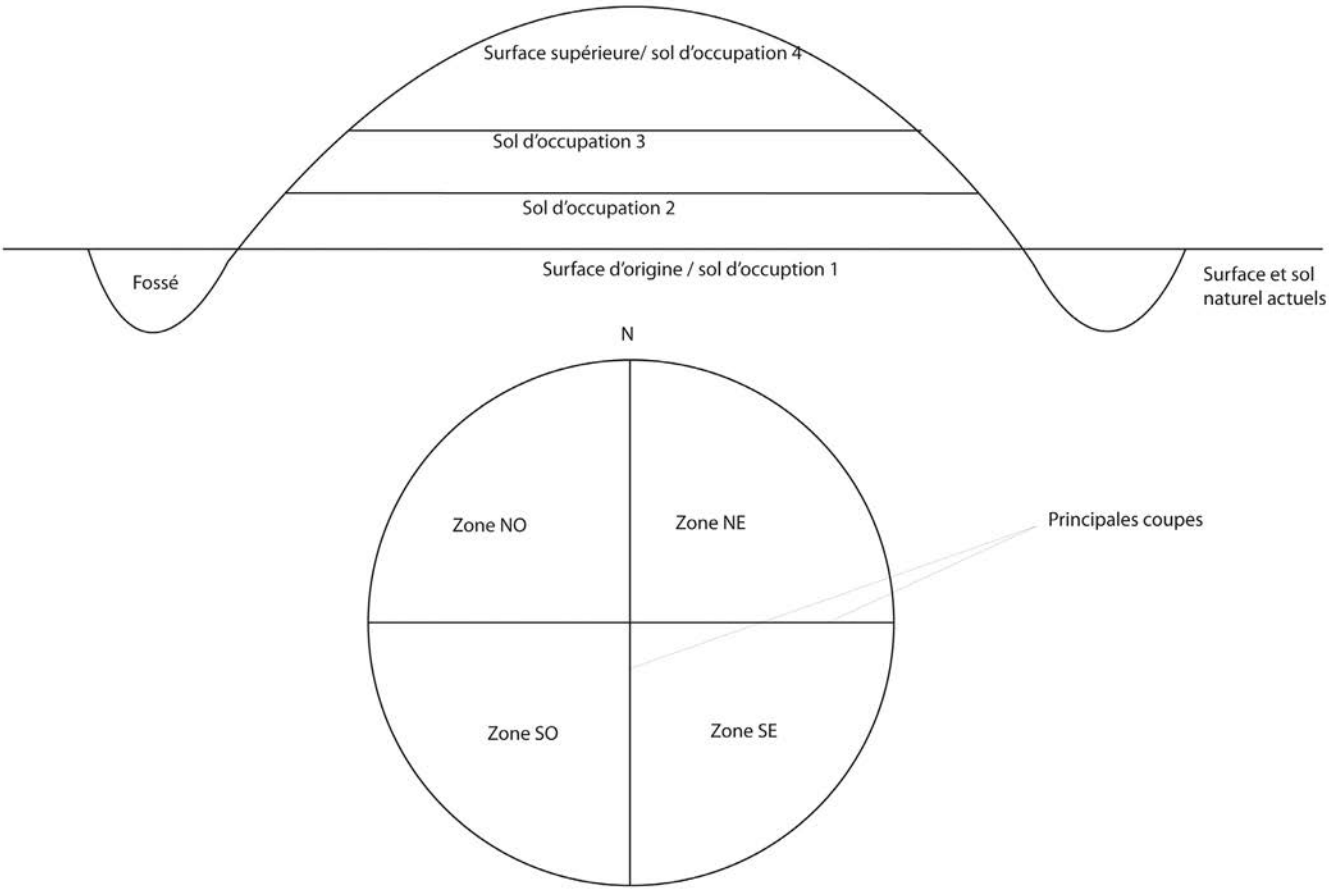
The preventive excavation of an entire medieval motte at Ecoust-Saint-Mein (Pas-de-Calais), threatened with collapse due to the presence of an underground passage, required drastic and well-considered selections. This is a textbook case in terms of methodological choices. In order to identify the particularities of this complex, multi-phase stratigraphy, the regular presence of a soil scientist was necessary, enabling decisions to be taken on priority sampling and its destination in line with scientific expectations. The whole process was discussed collectively, on the basis of comparable studies already carried out on other clods. Secondly, a report on soil observations, prior to the fieldwork, highlighted the importance of features associated with black earth, old buried surface horizons (cultivated?), backfill and combustion structures and rejects of various colours and compositions (black or red firing, ash, etc.). Finally, it was necessary to prioritise the analyses to be sent on the basis of an initial text, the inventory of samples and budgetary constraints. Although the lowest budget proposed had to be retained, this was done on the basis of reasoned choices discussed together. The studies underway concern micromorphology, granulometry and mineral chemistry analyses, as well as the study of phytoliths.

Keywords: Middle Ages, motte, stratigraphy, pedology, phytoliths, occupation soil, ploughing, hearths, black earth.

Illustration

Theoretical breakdown of the information to be gathered in the field and by analysis, by phase of occupation and by excavation area. It was proposed following the complete excavation of the mound for the purposes of analysis selection.

Credit: K. Fechner.



Geophysics on stripped surfaces: contributions and prospects.

POSTER

Guillaume Hulin, Francois-Xavier Simon, Benjamin Fores

Well-known for their exploratory applications over large areas, geophysical methods can also be used during excavation, after the surface horizons have been stripped, to help identify and characterise archaeological horizons.

This approach is mainly based on the measurement of magnetic parameters whose variations may be linked to anthropogenic phenomena (heating, presence of ferrous micro-waste, organic matter) but also to various pedogenetic processes. In certain contexts, these measurements can provide particularly relevant information by revealing anomalies, some of which are completely invisible to the naked eye.

These approaches, which have become more systematic in preventive archaeology, are of real interest, particularly for the study of ironworking sites. The physical anomalies generated by these activities are strong enough to be characterised with a good degree of reliability. The examples provided by preventive archaeology make it possible to propose new protocols for approaching the study of palaeometallurgy by providing, from the field phase onwards, spatial recognition of the distribution of ferrous micro-waste and thus targeting more precisely the areas to be sampled.

More subtle anomalies can also be studied using these methods. From helping to read the outlines of sepulchral pits to characterising occupation areas (buildings, etc.), there are many potential applications yet to be explored. While the study of forge soils has now become routine, the same cannot be said for these other areas, which are still in the research phase. The most widely used parameter is magnetic susceptibility, but other properties that are more difficult to measure (magnetic viscosity, hysteresis cycle parameters, etc.) may be of great interest in understanding anthropogenic phenomena. It is to these parameters, measured in the field or in the laboratory, that we must turn to open up new perspectives.

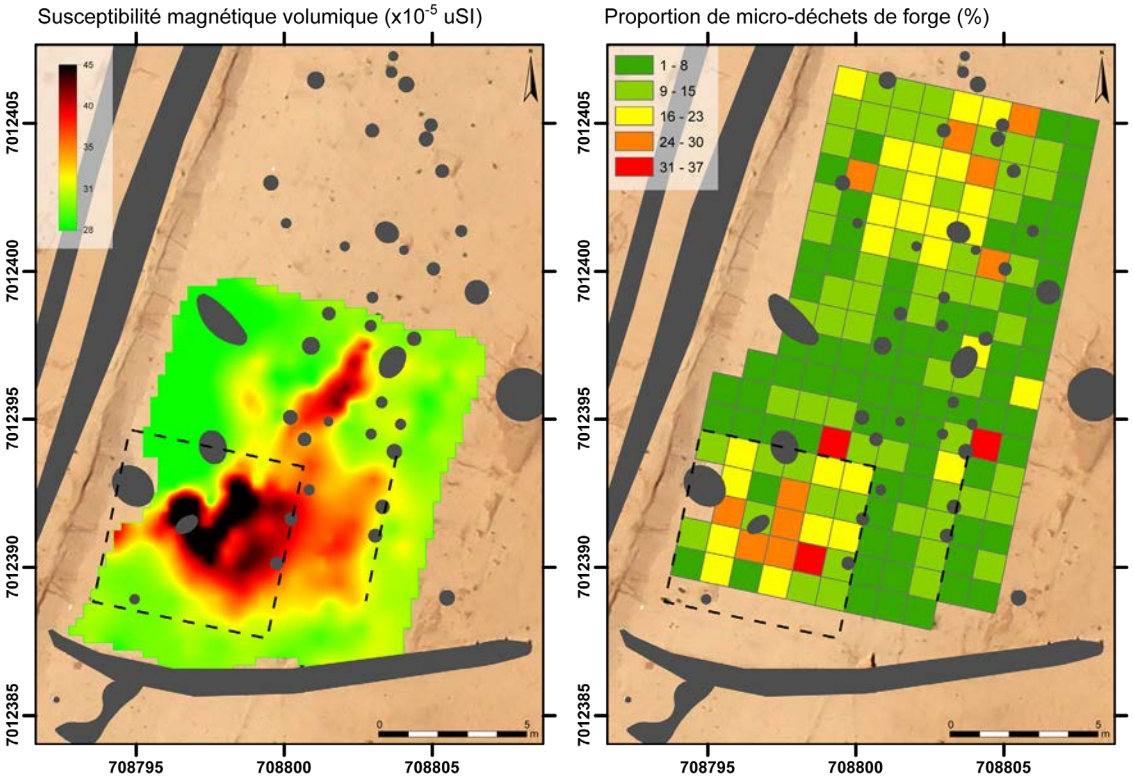
At the same time, the coupling of measurements of the magnetic properties of soils with geochemical data (XRF in particular) or multi/hyperspectral imagery needs to be developed. It is only by adopting an interdisciplinary approach that first and foremost integrates the archaeologist and his observations that we will be able to propose more precise interpretations of the detection and characterisation of archaeological horizons.

Keywords: geophysics, stripped surface, magnetic properties, geochemistry, multispectral imaging.

Illustration

Magnetic susceptibility mapping and palaeometallurgical sampling in sector 10 of the Sauchy-Lestrée site (62) with proposed zoning of the forge.

Responsible for operation: Ph. Lefèvre; geophysicist: G. Hulin; palaeometallurgist: B. Jagou.



Multivariate spatial geochemical analyses in archaeology and its potential for inter-disciplinary research.

POSTER

Jan Horak

Geochemical analyses have a long tradition in archaeological research and prospection, however, there is still a potential for its growth in quality and importance. Geochemical analyses can be performed in many ways, two of the most used are being laboratory measurements of the samples (ICP and so on), or direct in-situ merasurements usually by portable XRF devices, both having their advantages and disadvantages. But the methodology of measurement is only one of the crucial aspects in the chain of work – other being sampling design (grid density, sampling in more depth levels / soil horizons etc.) and its link to archaeological features and, mainly, the possibility of linking it to the data coming from other methodologies and disciplines.

The lecture presents the results of several studies made in the last years (sites from Czechia, Izrael and France). It focuses on their methodical aspects and the potentials and risks coming from various approaches. It also discusses the new approach to the integration of geochemical and geophysical data, which was developped as a part of the activities in the COST action called SAGA (Soil and Archaeo-Geophysics Alliance; action No. CA 17131; www.saga-cost.eu) and was also supported by project “Geochemical insight into non-destructive archaeological research” (LTC19016) of subprogram INTER-COST (LTC19) of program INTEREXCELLENCE by Ministry of Education, Youth and Sport of the Czech Republic.

Keywords: exploration, prospection, multi-elemental analysis, data integration, geophysics, magnetometry, chemical mapping, XRF.

Driving archeological interpretation of geophysical data using 3D geomodelling.

POSTER

Paul Cupillard, Judith Sausse

Geophysical prospection methods make it possible for archeologists to investigate sites in a non-destructive way. They provide images of physical properties (electrical resistivity or conductivity, magnetic or gravity anomalies, seismic or electromagnetic wave velocity contrasts) of the underground over large areas. Interpretation of such images can reveal archeological and sedimentological structures, which helps in better understanding a site and/or estimating the potential of it prior to excavation. However, interpretation can be ambiguous due to:

1. the uncertainty derived from the imaging process,
2. the limited resolution of the obtained images,
3. the sparsity of the observations.

In this work, we show how geomodelling tools can guide the interpretation of geophysical data. Relying on the Gombervaux case study (late Middle Age, France), we use Discrete Smooth Interpolation (DSI) to build triangulated surfaces in 3D from features identified on maps and vertical sections. Although developed for geological surfaces, DSI can model archeological structures as well if relevant data constraints and mesh resolution are chosen. The obtained surfaces lead to a 3D model of the underground, which considerably eases its understanding as compared to a purely visual inspection of the geophysical images. Moreover, such a model can be modified in a stochastic way to sample the uncertainties associated to the geophysical data.

Keywords: Gombervaux, geophysics, geomodelling, uncertainties.

Multi-element analysis: towards the interpretation of invisible evidence of past human activity.

POSTER

Arthur Laenger, Arnaud Martel, Aline Durand, Fabien Boucher

Studying the chemical elements present in soils to distinguish anthropogenic contributions is not a new idea. The seminal research of Olof Arrhenius in the post-war years laid the foundations for the study of phosphorus, contained in phosphates, in archaeological soils. Various analysis methods were developed and the study of this element is now regularly used in archaeology to assess grazing areas and structures associated with livestock farming. At the very end of the 1970s, proposals for multi-element studies were put forward and implemented with varying degrees of effectiveness. The development of X-ray fluorescence spectrometry provided archaeology with a reliable and inexpensive analytical tool. Thanks to this technique, other interesting elements have been uncovered, improving the possibilities for interpreting geochemical analyses in archaeology. While metals such as iron, copper and silver are ideal and rather obvious candidates for highlighting metallurgical activities, other more enigmatic elements have been revealed by cross-studies between analysis data, archaeological observations and consultation of historical sources. In particular, the interest of the elements sulphur and manganese will be detailed on the basis of archaeological examples.

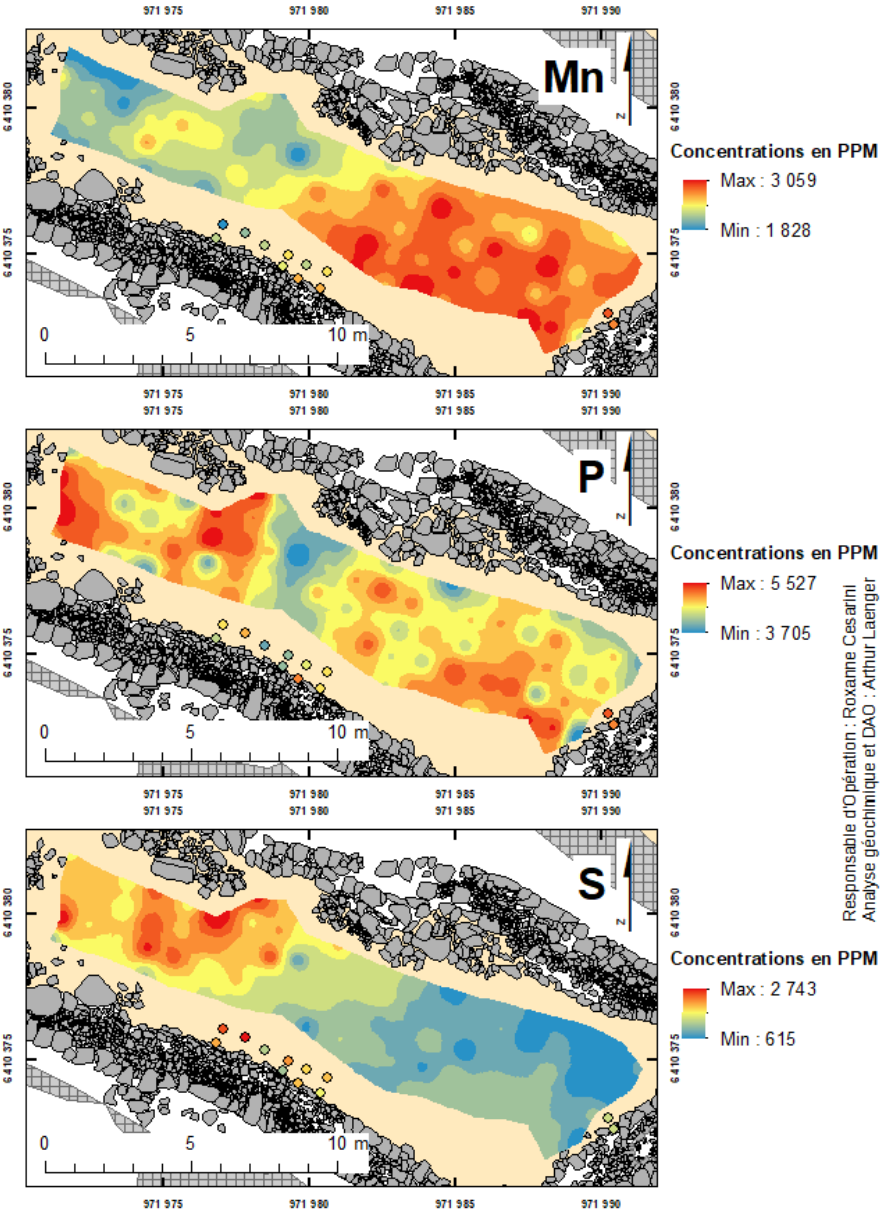
[Translated with www.DeepL.com/Translator]

Keywords: XRF, geochemistry, markers, phosphorus, sulphur, manganese, activity, occupation, soil.

Illustration

Distribution maps of chemical element concentrations on the Pré Gauthier 1 structure.

Credit : Arthur Laenger.



A fuller's workshop at Saint-Épain? An example of a constructive dialogue between fieldworkers and specialists to characterise production structures in the ancient countryside - chemical analyses and interpretations.

POSTER

Sandrine Bartholome, Morgane Liard, Carole Vissac, Pascal Verdin, Nicolas Garnier, Grégory Poitevin

During the excavation of a Gallo-Roman rural settlement at Saint Épain (Indre et Loire), a series of craft pits were studied. Despite the fact that the site had been levelled, these pits revealed some distinctive morphological features. Prior to their exploration, the aim was to understand how they were used so that an appropriate excavation protocol could be applied. As early as the field phase, the morphology of this complex indicated a desire for fluid flow. The use of large quantities of water is reminiscent of similar devices attested in the Gallo-Roman world in connection with several types of craft: tanning, basketry and fullery. In addition to its function, this discovery raised questions about the identification of this complex. In agreement with the regional archaeology department, it was decided to try and determine its function. A dialogue was then established between archaeologists, geomorphologists and specialists in order to define a sampling and study protocol likely to shed light on the use of these pits. The definition of archaeological expectations, the geomorphologist's taphonomic assessment of the whole site and the implementation of the most relevant analyses by specialists led to the identification of a fullery.

The aim of this presentation is to illustrate the considerations and choices made to identify this type of structure by comparing structural/typological, bioarchaeological and geochemical criteria. The results of this operation offer a window onto the cross-fertilisation of archaeological data and analyses, enabling us to reflect on the productive parts of rural settlements. Identifying the function of these structures, and hence the activity of farming estates in the High Empire, is essential; it also raises the question of the ancient economic development of the Sainte Maure de Touraine plateau.

The results and experience gained from these structures mean that the approach developed on other sites with such remains can be extended, highlighting the value of joint geoarchaeological, archaeological and bioarchaeological readings.

The knowledge acquired in this way will enhance current research and future summaries on the economic activities of ancient rural settlements in the Centre region.

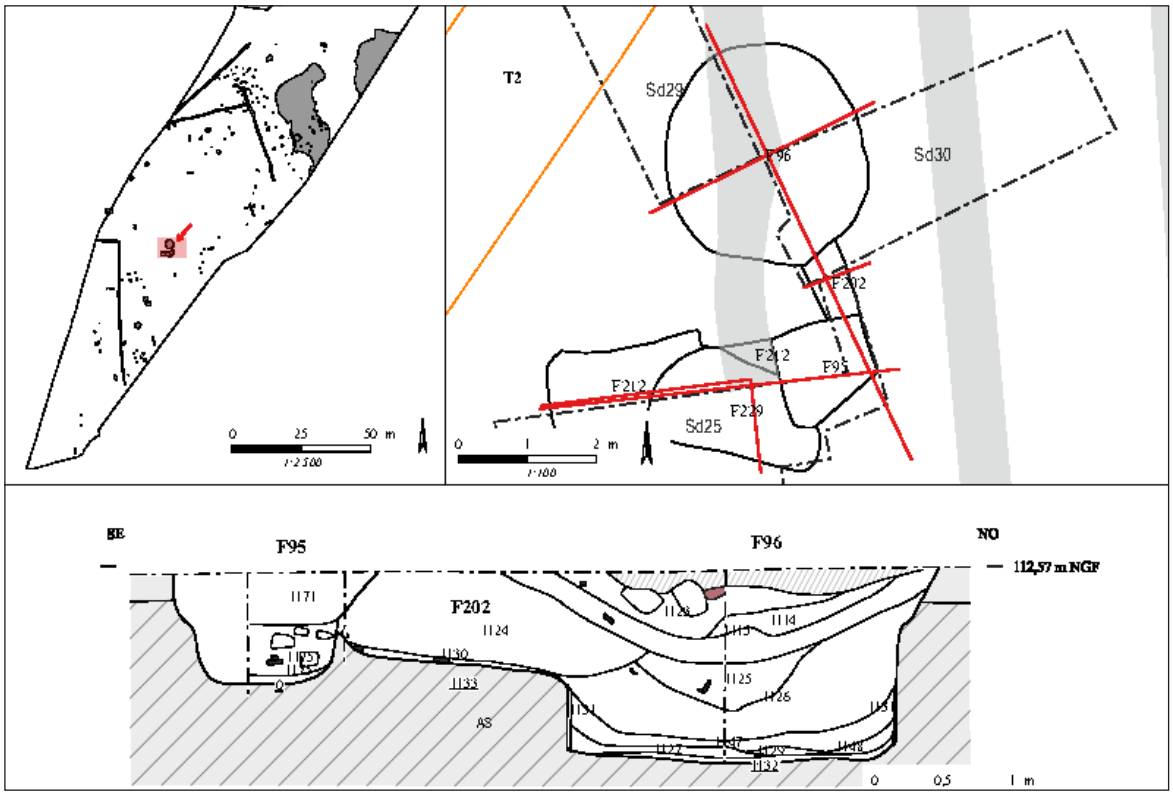
[Translated with www.DeepL.com/Translator]

Keywords: archaeology, craft structures, bioarchaeological analyses.

Illustration

Location, plan and section SE-NW of the Foulonnerie.

Credit: Léa Roubaud, Inrap.



Cross-reading archaeological spatial data: the example of the ancient peri-urban sanctuary of Mâlain (Côte-d'Or).

POSTER

Loïc Gaëtan, Marie-Agnès Widehen, Benjamin Fores, Francois-Xavier Simon

To the west of the ancient town of Mâlain/Mediolanum (Côte-d'Or) lies one of the most important ancient sanctuaries in the Lingon region. Discoveries made during the 19th century and aerial data acquired since the 1960s have shaped its regional reputation. In 2014, an Inrap preventive archaeological survey of around 25% of the site's surface area yielded the first chrono-stratigraphic data showing that the remains were in a relatively good state of preservation. Given this potential, a collective research programme was set up in 2021 (dir. M.-A. Widehen, L. Gaëtan, Inrap BFC, UMR ArTeHiS) with the aim of creating a synthesis of knowledge. The main objectives are to understand the internal topography and function of the sanctuary's spaces, its chronological evolution, worship practices and the factors that led to its establishment. The survey revealed that a wetland had existed here prior to human development. The discovery of a series of drains beneath the monumental complex and of deities linked to water (Sirona) illustrates that it belonged to the category of water sanctuaries.

One of the aims of the PCR is to cross-reference all the spatial data acquired in order to determine the organisation and spatial development of this sanctuary. This information is primarily derived from aerial and geophysical (electrical, magnetic and radar) surveys. The introduction of a georadar survey in 2021, covering 3 hectares, is the major step forward in recent years in providing a comprehensive understanding of the complex. In addition to this type of data, we need to add the diagnostic data, which will enable us to make an unprecedented comparison between the actual state of conservation of the remains and the interpretative data from the surveys. The maps produced at the end of the protocol for identifying and characterising the anomalies detected provide a cross-sectional map with reliable criteria for interpreting the functional nature of the areas. In addition, the data provided by the observation of structures and sedimentary layers during the diagnostic phase sheds light on the extensive results of the geophysical surveys. Finally, the chronospatial information collected can be compared with the radar results. This information can be used to refine our understanding of the maps and the development of the complex. The Mâlain site is therefore an interesting example of interdisciplinarity bringing together archaeologists, geomorphologists and geophysicists.

Keywords: Gallo-Roman, water sanctuary, archaeological prospecting, radar geophysical prospecting, topography, geoarchaeology.

Illustration

Mapping the different methods of acquiring archaeological data on the Mâlain sanctuary.

Credit: L. Gaëtan, M.-A. Widehen, Inrap.

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This symposium is supported by regional archaeological service of DRAC Centre-Val de Loire and by the French National Research Agency (ANR-18-EURE-0001) under the “Investissements d’Avenir” programme.