



**Figure 1.** A few examples of soil characteristics that can be observed in the field.  
(Photos Roger Langohr)

# FROM SOIL SURVEYS TO ARCHAEOLOGICAL SITES AND BEYOND

## Research strategies and original approaches for interpreting soils, anthropic activity, and environmental changes

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### ‘The soil is a book’

The importance of soil science in various research fields has increased tremendously over the past decades. Soils are among the most fundamental elements that support life on Earth. They provide numerous ecosystem services and document past environments and cultural heritage. Many renowned scholars contributed to this understanding; amongst them Roger Langohr. For more than 50 years he has been an international authority within various fields of soil science research and as such he contributed substantially to the improvement of interdisciplinary research strategies. His holistic approach on understanding the book of nature through field observations of soils has inspired researchers from far beyond the borders of Belgium. Those who had the privilege to follow his lectures or collaborate with him have learned that to understand soils, one has to start in the field by observing the soil characteristics, by drawing them, and by recording their vertical and horizontal variability (Figure 1). Additionally, profiles should (always) be made very deep and wide (deeper and wider than they are often dug) to overcome local variability (Figure 2). Indeed, countless

times we could observe that by enlarging soil profiles the first hand interpretation would change considerably. One also needs to face the complexity and be aware of the fact that the absence of features is as important as their presence. We were also taught that soils have to be studied on various scales, from a macro, to meso and to a micro scale (Figure 3). Each soil profile can be considered as a page in the book of the history of the larger soilscape. Thus, in order to understand the whole story, one needs to read all the pages and chapters.

With this book, we would like to pay honour to all the scientific contribution of Roger Langohr, who manages to fascinate, motivate and promote scientists that are active in various research fields and come from all parts of the world.

### Questions raised in this book

In the past few decades, soil science has contributed greatly to discussions on climatic and environmental changes, as well as to the understanding of various topics of human impact on landscapes and the environment. This



**Figure 2.** Profiles should (always) be deep and wide.  
(Photos Roger Langohr)

book aims to address these complex issues and demonstrate how they are approached and unravelled through past and current interdisciplinary research. In the following chapter, the reader will find views and diverse research strategies of answering the following questions:

- What is the current state of research on soils as a record of past and present?
- How is soil research able to contribute to the unravelling of important archaeological issues?
- How do formerly collected soil data help us today?
- Can we still learn from nature through field observation?
- Is there still time to do fieldwork?
- Is fieldwork sufficiently relevant, or should it be entirely replaced by graphs and modelling?
- How do we deal with limited budgets when an infinite number of soils characteristics exist, and many analyses are possible?
- How to continue when sometimes authorities are reluctant, and collaborations are hampered?
- What are some of the future challenges?

In answering these questions, the twenty-one papers that follow address a broad range of subjects and cover a wide geographical scope: soils and related questions from Belgium, France, Hungary, Luxembourg, Spain, and Switzerland are presented. These contributions testify that an interdisciplinary approach, since long advocated by Roger Langohr, works well and proves it to be a successful tactic.

In Belgium, systematic soil surveys were carried out right after World War II until the beginning of the 1980s. Even today, small-scale surveys are still executed according to the survey principles, methods, and field legends worked out almost 70 years ago. The huge amount of data collected during these decades of intensive prospections are still relevant today and applied for various purposes. The data are included in the Flanders Subsoil Database (*Databank Ondergrond Vlaanderen* or DOV), which is freely available to all users as presented in the paper of K. Oorts et al. DOV connects, develops, and disseminates information about the soil and subsoil of Flanders and is an outstanding example of how to apply soil science data that were gathered in the past to handle issues of the present and future.

Among the numerous questions targeting soils nowadays, a frequent question is the one of how to preserve heritage. The contribution of C. Ampe and K. Gheysen emphasises that pedologists and archaeologists are strongly needed to increase the awareness of the heritage

value of soils and various remains of anthropic activity incorporated in soils. They present an interesting case from Flanders (Belgium), demonstrating how soil science and archaeology can be involved in land development projects.

Understanding past soils and among them the original soil(s) (i.e. the soil(s) that existed before deforestations and agricultural practices) is one of the research topics thoroughly investigated and often taught by Roger Langohr. Thanks to him, nowadays, it is widely known that the Sonian Forest (Belgium) is a unique heritage site for earth sciences and archaeology. The paper presented here by Roger Langohr is supported by data collected throughout many years of comprehensive field observations, carried out during all seasons, among others in the Sonian Forest. These data permit us to understand the settlement dynamics of Neolithic farmers in this part of the world, where both the chemical and physical fertility were strong limiting factors for food production. These soils were still widely present in Central Belgium during Roman times, as revealed by the paper by S. Dondeyne and S. Deckers, who combined the soil classification and soil evolution issues in an original questioning of the Abc soil types. Their data illustrate how understanding soil formation processes helps us to comprehend the past evolution of landscapes and land-uses.

The landscape evolution and past groundwater fluctuation in the Mol-Dessel Area, north-east Belgium could be reconstructed through field soil survey techniques as presented in the contribution of K. Beerten. This approach drew attention to the fact that the distribution and thickness of drift sands covary with the morphology of the buried Podzols and that these data can be used to reconstruct water-table variations.

It is well known that in the past soils were among the resources that influenced the functioning and wealth of communities. As such, when soils presented marginal suitability for agropastoral activity, farmers had to find solutions to improve their soils. This is well illustrated in the interdisciplinary paper of J. Hinsch Mikkelsen et al. that presents the functioning of Roman-dated stable houses through morphological and analytical data, providing chemical amendments in the quartz-rich, nutrient-poor region of the northern Campine (Belgium) area. Plaggen-like soils are the result of centuries of such management and they are the witnesses of the sustainable subsistence strategy adopted by the inhabitants. The question concerning the soil's fertility is also addressed in the article of J. Deák et al. about the nutrient rich, but often poorly drained and/or clay rich soils that existed in the surroundings of Late Bronze Age lake-dwelling sites, located near Neuchâtel (Switzerland). Here, comparative analyses of archaeological and pedological data of two settlements



**Figure 2.** Soil is a book and it has to be studied at all the scales.  
(Photo Giovanni Boschian)

situated in two distinct bays, surrounded by lands with markedly distinct agro-forestry potentials, suggest that the two communities kept in close interaction throughout their development and in handling the lake-level variation challenges.

Understanding soil forming processes is crucial for understanding artefact distribution and might have important implications for archaeological surveys as demonstrated by the multidisciplinary approach in the contribution of Ph. Crombé et al. This original study suggests that in the region of the Belgian-Dutch sand belt, in the augering survey projects focussing on Mesolithic and Neolithic sites, the sampling depth should be adapted to the different soil types. The paper of J. Vanmoerkerke et al. provides an example on how ignoring soil science and ecological data might bring about erroneous archaeological interpretations. This is the case with vertical and slightly inclined wood fragments in soils, that are most often interpreted as posts witnessing former buildings, fences, etc. This paper recalls that, as demonstrated by Roger Langohr more than 20 years ago, these features might simply be large tree branches pressed into the soils by the weight of a falling tree. Their correct interpretation allows for valuable dendrochronological records for periods little documented so far, as is the case in the north-east of France.

The question of origin of charcoal in soils is another often discussed subject in archaeological contexts. The paper of C. Menbrivès et al. brings novel reflections and data on the origin of combustion residues. This multiscale interdisciplinary case study, triggered by combustion traces documented in the Ardennes (Belgium,) encouraged the authors to review the various ways of how charcoal arrives in soils. Through this, they emphasise the

often neglected technique of 'écobuage', that consists of the preparation of soils for crop production with a preliminary extraction, burning, and reintegration of the surface sods. M. Rué and A. Hauzeur, in turn, explored the delicate and still little studied subject of differentiating natural and anthropogenic soil characteristics through micromorphology. Their combined field and micromorphological study, focussing on a presumed habitat site situated near Paris (France), showed that earth fragments, initially interpreted as earth building material fragments, are likely to be the result of natural pedogenetic processes. Micromorphology is a crucial tool in studying Dark Earths, too. The case study describing a site of Aalst (Belgium) by Devos et al. illustrates how succession and superposition of anthropic activity and natural depositional events can be unravelled by facing complexity and using interdisciplinary research techniques.

The paper of F. Cruz et al. is an interdisciplinary study presenting the challenges of documenting the alluvial settings of Kerkhove Stuw (Belgium) in a rescue archaeological context, where time is short and the amount of data to document and investigate is huge. The paleoenvironmental reconstruction presented in this paper is complemented by an evaluation of potentials and limitations of various field recording techniques and, as such, it highlights the crucial role of field work, as often emphasised by Roger Langohr. Several case studies inspired by rescue archaeological prospections and excavations from Lorraine (France), presented by A. Gebhardt, testify to the potential of combining field and micromorphological techniques. She emphasises the benefits of a systematic follow up of archaeological interventions performed in a large region. Moreover, she points out that a strong personal determination is also needed when the administrative load replaces the time foreseen for research and interdisciplinary collaboration. The paper of Fechner et al. synthesises twenty years of studying soil characteristics and their significance related to anthropic activity. This contribution concerns Neolithic and Bronze age sites located between the Rhine and the Sein (Belgium, Luxembourg, and the north of France).

On a more local scale, the contribution of F. Beke et al. narrates the long and complex history of a barrow excavated in north-western Belgium. Starting out as another routine archaeological excavation, the interdisciplinary approach chosen here proved to be a crucial decision. The soilscape and micromorphological analyses completed the archaeological documentation and revealed that this burial mound, that was constructed during the Bronze Age, witnessed multiple renaissance phases through new functions and morphological modifications that occurred during the Late Iron Age, Roman Age, and High Middle Ages. D. Verwerft et al. discuss the successful collaboration of

archaeologists and earth scientists in discovering and characterising a Roman terp, another type of man-made raised platform, situated north of Bruges (Belgium) in the tidal estuarium of the Zwin. Overall data permitted them not only to unravel a good knowledge of the landscape and its opportunities, but also to point towards the engineering skills employed at that time and the considerable organisational tasks effectuated.

Looking at soil characteristics is also proven valuable when scientists are interested in paleoenvironments. A. Mindszenty, while looking at paleosols outcroppings in Hungary that formed on Late Triassic carbonate platforms, highlights the importance of a process-oriented approach, rather than targeting the classification. The paper of E. Horváth is an interdisciplinary revisiting of several famous Quaternary loess sections situated in Hungary. The palaeosols preserved in these sediments are known as important stratigraphic markers and this contribution underlines the importance of the documentation of the variability of soils characteristics for a novel understanding of landscape evolution and climatic changes. Past environments are also recorded in the present-day soils. This is thoroughly explored in the paper of R. Poch et al. through field, micromorphological, and analytical data collected for soils from the Tremp basin (NE Iberian Peninsula).

The last paper of the book reviews the history of teaching soils science to archaeologists in Flanders (Belgium). M. Pieters explains that, although soil science is crucial for understanding archaeological issues, such training in Flanders was only possible for a short time. It was done in the frame of the International training Centre for Post graduate Soil Scientists, a worldwide known institution, where the highly skilled teaching staff taught soil forming processes, micromorphology, soil mineralogy etc. Among them, Roger Langohr kept the doors wide open to archaeologists and at the same time guided fellows with various academic backgrounds to discover the wonderful pages of the book of soils on archaeological sites. Today, these doors are closed and this a serious issue when archaeological interventions face an increasing demand in earth science expertise.

To conclude, every one of these papers are examples on how looking at soils, soil characteristics, and processes with an open-minded approach, allows for a better understanding of the complex and fragile interactions between human societies and their environments. Today, when environmental questions are more than actual, the original research strategies presented here, often appealing to the collective intelligence, are also meant as an intergenerational transmission of knowledge.

## A participative project

The organization of a meeting entitled ***‘Soils as records of Past and Present: the geoarchaeological approach. Focus on: is there time for fieldwork today?’*** was first formulated in September 2018; the first, preliminary, call for participation was distributed in December 2018. The main organisers Judit Deák, Jari Hinsch Mikkelsen, and Carole Ampe are all alumni of the International Training Center for Post-Graduate Soil Scientists at the University of Ghent. In the 1990s they were students and collaborators, working on MSc. and Ph.D. thesis and working on various scientific projects under the supervision of Roger Langohr. The time they spent in ‘the corridor’ C, building S8 of the Sterre Campus was characterized by intensive field and laboratory training, scientific challenges and all that in an inspiring environment. The solid and broad scientific background that they acquired during these years was complemented by fantastique opportunities to meet other fellow students and scientists, and to build up a network of friendships and scientific collaborations that has lasted ever since.

After a first call for contributions, the response and interest from the scientific community for the conference was overwhelming, which showed the relevance of organising this meeting. Initially we thought of a one-day meeting with self-printed papers. But, like in the ‘old days of team Corridor C’, and in the spirit of one of Roger Langohr’s favourite sentences “small is beautiful”, the original project evolved and diversified and ended up becoming a two-day meeting with a scientific excursion, followed by a scientific symposium, and accompanied by a book with twenty-one reviewed papers, printed by a professional printer. This evolution meant, for all involved, a lot of self-engagement, the capacity for rapid adaptation, cooperation, and mutual understanding, as several organisational aspects changed with time and the final deadline was very short.

The first call for contributions to this book was launched in January 2019 with a deadline of 15<sup>th</sup> of June 2019 for the first manuscripts, to be reviewed during the summer and the final versions to be submitted by the 5<sup>th</sup> of September 2019. This schedule is almost synonymous with ‘mission impossible’, yet the book is here. This was only possible thanks to the strong motivation and dedication of not only the organisers, but also of all the contributors and reviewers. Despite the considerable extra working load, the authors and co-authors of the papers in this book managed to write and submit their contributions in record time. They were also asked to assume not only the scientific and copyrights responsibility of their work, but also the verification of content and formatting of bibliographic data included. The scientific reviewers (see list

here below) played a crucial role in the accomplishment of this publication. Their constructive remarks and suggestions contributed generously to the scientific quality of the papers, while their rapid feedback and interactions were decisive in meeting the deadline and having all the papers in the book.

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Raakvlak, Archaeology, Monuments and Landscapes of Bruges and Hinterland, assumed the logistics and financial side of the organisation of the meeting and book editing. The enthusiastic commitment of the entire team of Raakvlak permitted an appropriate set up of the many aspects involved with the organisation. We would like to express our sincere gratitude and appreciation in particular towards archaeologist Mariebelle Deceuninck, who handled the administrative parts of the organisation, the general communication, and did the enormous work of technically editing this book. Also, archaeologist Caroline Landsheere did the essential job of improving the English language of most of the papers, for which we are strongly indebted. The tremendous work of finalising all papers for printing was carried out by Frederick Moyaert from the publishing company Van de Wiele, for which we are sincerely grateful.

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As mentioned above, 14 scientific reviewers, through their prompt and generous involvement, permitted editors and contributors to improve and finalise the papers. We would like to express our highest appreciation for all their work.

The idea of organising a meeting in the honour of Roger Langohr was first time launched by Jan Vanmoerkerke and we would like to thank him for raising the question that led us into this adventure.

For planning, organising, and executing the excursion, we would like to express our sincere gratitude to W. De Clercq, J. Trachet and R. Dreesen for their enthusiastic input.

The organisation of the venue would not have been possible if it was not for the facilities offered by the City of Bruges and the Museum of Bruges. City of Bruges will in 2020 celebrate their 20th year of UNESCO World Heritage status. By supporting meetings like this, they commit to this status.

To conclude, this participative approach of all people involved testifies to the genuine interest to follow, share, and transmit Roger Langohr's field and holistic scientific approach. Last but not least it is clear that there is a continuous interest in understanding the book of nature and that cooperation and interdisciplinarity are powerful tools to move forward.

The background of the cover is a classical-style landscape painting. In the foreground, a large, dark tree trunk with intricate root systems stands on the left. Below it, a sandy bank with sparse grass and small plants leads down to a path. In the middle ground, a body of water reflects the sky, with a white windmill on the right and a cluster of buildings, including a prominent church tower, on the left. The background shows a distant town or city under a hazy sky.

# SOILS AS RECORDS OF PAST AND PRESENT

From soil surveys to archaeological sites:  
research strategies for interpreting  
soil characteristics

*Edited by*  
Judit Deák  
Carole Ampe  
Jari Hinsch Mikkelsen

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