



Reading the Soil Archives: Unraveling the Geocological Code of Palaeosols and Sediment Cores. Jan M. van Mourik and Jaap J. M. van der Meer (eds). Elsevier, Radarweg 29, P.O. Box 211, 1000AE Amsterdam, Netherlands. 2019. xiv + 305 pages. Price: US\$ 175.00.

The study of the earth's surface and its processes has emerged as a multi-disciplinary knowledge domain that emphasizes the integration of datasets drawn from various disciplines such as geology, geophysics, climate science, physical geography, geomorphology, pedology, hydrology, geoecology and archaeology. As emphasized by the editors of this volume, it is this integration of multi-disciplinary datasets from different subjects that furthers understanding of the processes responsible for the dynamics of ecosystems and the evolution of landscapes. The nineteenth century concepts of zonality of landscapes led to the production of physical maps of the earth's surface (climate, terrestrial biosphere, geomorphology and soils) together with research that focused on zonal differentiation and landscape evolution. An important aspect of this multi-disciplinary approach is the understanding of soil archives using a range of appropriate techniques that have been established in related disciplines. These include techniques that are based in mineralogy, clay mineralogy, palynology (pollen analysis), ecology and limnology (diatom analysis) and soil science (soil micromorphology). Employing these techniques together with soil mapping and geomorphological mapping results in the analysis and interpretation of soil archives that in turn informs our understanding of earth surface processes, global change and in some cases archaeological reconstructions.

In the Anthropocene world, environmental change is caused by both natural and anthropogenic processes. The modern world is one where scientists are concerned with tipping points and tipping elements in the earth's surface systems. Therefore, the environmental changes that are recorded in the various terrestrial environments on the earth's surface are particularly important. Such studies commonly focus on peat and lake deposits, and on (palaeo)soils in order to unravel the rates and types of environmental change in the earth's surface systems. This volume assigns soils and palaeosols a pivotal place and highlights their usefulness as geoecological and geoarchaeological archives for obtaining insights into the dynamics of environmental change – both ongoing and that of the recent past (for example, the Anthropocene and the Holocene).

This volume consists of eight chapters, besides a short introduction. Chapter 1, authored by the editors themselves, provides an overview of the significant and well-established method of soil micromorphology. Using examples from a variety of earth surface settings, this chapter underscores the value of polycyclic soil sequences as geological archives of landscape evolution in driftsand areas. Chapter 2 is devoted to soil pollen analysis. Herein, it is emphasized that the processes of infiltration and conservation of pollen in soil, elucidated through the method of soil micromorphology, are critical for the detailed interpretation of the soil pollen spectra. The next technique presented in the volume deals with the radiocarbon dating of soil organic carbon. In this method, it is emphasized that the aspects that require particular attention are the detailed knowledge of the dating process, properties of the sampled profile and the extraction of the soil organic carbon. Both ^{14}C measurement techniques (conventional and accelerator mass spectrometry – AMS) are discussed with reference to timescale calibration, sample quality and sample pre-treatment. Further, examples of the dating of vegetation horizons and the dating of bog peat have been included in this study. This aspect of dating soils and sediments through radiocarbon is followed with an account of the now common and popular method of optically simulated luminescence (OSL) dating. In the words of the authors of this chapter, the application of OSL dating to the soil archives is not

straightforward. Using three case studies, the authors have attempted to 'illustrate the possibilities and limitations of luminescence dating for enlightening soil archives'. An example of using the single-grain luminescence dating method for reconstructing soil mixing and transport is particularly revealing. Through other case studies on the polycyclic drift-sand deposits and plaggic Anthosols, the authors have been able to demonstrate the difference in ages of the organic and the mineral fractions of soil samples. Such dating studies provide useful insights both on the provenance of the sediments/soils as well as on the dynamics and storage of the soil organic matter. The relatively new method of biomarker analysis has also been included in this volume; biomarkers as used in this volume 'refer to specific molecular characteristics of organic matter that may be diagnostic of specific organisms, classes of organisms, or general biota that contribute organic matter to the atmosphere, aqueous or sedimentary environment'. Besides the chapters on pollen and biomarker analysis, this volume includes a chapter on phytolith analysis. Phytoliths are rigid, microscopic structures made of silica, and are found in some plant tissues. They survive decomposition and humification of organic tissues and can therefore accumulate in the soil. Phytolith analysis is a promising method for the reconstruction of the vegetation that has influenced soil genesis, particularly so in those locales/settings where pollen is absent due to the processes of humification and mineralization. Soils and palaeosols are made up of both mineral matter and organic matter, and their understanding requires the knowledge of the sources of this matter. The subject of



Fragments of tiles produced in the relics of the Roman tile-works close to mardel Kalefeld (length of the bar is 1 cm).

pedogenic provenance analysis has been presented in chapter 6, and has largely been illustrated through case studies that have employed techniques such as SEM-EDX and WD-XRF to obtain insights into the provenance of soil materials. Finally, this volume also raises the question ‘Can geodiversity help to save the soil archives?’ This discussion is a recognition of the fact that soils are an integral part of nature’s diversity, and that there are ‘threats to soils and palaeosols as elements of geodiversity’. The larger view advanced in this study is that although soil conservation is commonly limited to combat soil erosion and land degradation, it should additionally include the aspects of soil heritage and soil diversity, just like it is done in the case of biodiversity. Case studies have been provided and the one on the soil loss and erosion rates of the European Union is worth mentioning here. A key message emerging from this study is that soils should be protected at various scales from local, to national, to global. Consequently, actions are required through protection and legislation to preserve soils and geodiversity from local to transnational levels. Why should we be so concerned about our geodiversity and the related soil heritage? We need to remind ourselves that soils, like water and air, form the foundation of our societies (food security); as well as that palaeosols are important as they are the recorders of both environmental changes of the past and our collective heritage (as inherited through the Holocene).

Reading the *Soil Archives* has been an illuminating experience; it is a valuable addition to the literature in the area of Earth Surface Processes, and is of particular relevance for those interested in using the soil archive to unravel the geoecological code of palaeosols and sediment cores. This volume will remain an important reference particularly for gaining knowledge about the methods that are in use for analysing the soil archives and sediment cores. Overall, this volume fits well into the larger Quaternary science perspective of the earth’s surface systems and subsystems, as they evolve in an Anthropocene world.

The examples and case studies used in nearly all of the chapters of this volume are from the Netherlands. Although this may be somewhat limiting from the point of view of the readers who work in other regions of the globe, it does provide an

interesting perspective of research being carried out in that part of Europe on the soil archive in the larger Quaternary perspective. This volume is highly recommended particularly to those interested in employing the wide range of methods and techniques that are increasingly being used for the description, characterization, and interpretation of the soil archives as part of understanding earth surface systems and processes in a Quaternary science perspective.

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Annual Review of Neuroscience, 2020. Botond Roska and Huda Y. Zoghbi (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 43, xiv + 539 pp. Price: US\$ 118.00. ISBN: 978-0-8243-2443-8.

The recent issue of *Annual Review of Neuroscience* is a fun volume to browse. It is a collection of state-of-the-art articles that deal with topics of wide contemporary interests, in addition to less frequented niche areas demanding urgent attention. As expected, hippocampus draws maximum coverage. Although we know a lot about the connectivity over DG, CA3 and CA1, CA2 continues to be poorly understood. The article on ‘CA2: A highly connected inrahippocampal relay’ unravels the circuit complexities within CA2 and debates its special role in social memory. Magee and Grienberger take a different line of enquiry. They review the development of post-Hebbian concepts leading to the directed type of synaptic plasticity. How the plasticity may enable a neuronal population to refine its activity toward a specific target or goal is an exciting concept being pursued. While formation of memory continues to mystify, amnesia, another side of same coin, begs for resolution. In their engaging review on ‘Impairments to consolidation, reconsolidation, and long

term memory maintenance lead to memory erasure’, Haubrich *et al.* evaluate the mechanisms underlying amnesia. They evaluate competing hypotheses on whether amnesia should be attributed to eradication of memory traces or that the traces are already present, but inaccessible. The weight of the current literature seems to favour the former view.

To decipher how brain processes time is perhaps as hard as understanding time itself. This challenge has been shouldered by Issa *et al.* We are introduced to the brain regions and behaviours associated with encoding of time across a broad range of time scales. The authors borrow ideas from our understanding of navigation in space, and then apply those rules for interpreting the role of circuits in measuring time. One way to understand brain is to isolate a circuit on the basis of its function and determine how it interacts with other circuits. Mesolimbic-reward system strikes as a classical example with dopamine as a prime agent for its output. However, in the article entitled ‘Reward contributions to serotonergic function’ Lie *et al.* provide insights on the serotonergic regulation of behavioural functions in the context reward processing. Serotonin seems to work both synergistically and antagonistically with midbrain dopamine system and shape motivational character that drives the response to rewarding stimuli. Mechanisms that enable the newly born mammals to suckle milk constitute the theme of the article by Maynard *et al.* The review gives the essence of biomechanics, circuits and genes necessary to regulate normal suckling behaviour and shape development.

Shifting the focus from the traditional circadian oscillators in the brain, Artushin and Sehgal make a compelling case for the role of astrocytes in circadian rhythms. Sifting through the information in fly as well as mammals, the authors evaluate the impact of genetic manipulations in glia on alterations in behavioural rhythms and ascribe a role for astrocytes in influencing rhythmicity in suprachiasmatic nucleus. How the odour representations are linked to perception has been a matter of enquiry for long. Unlike other sensory systems which are activated by a limited sensor types, the olfaction draws from a very large population of odour receptors driven by an equally large number of genes. The olfactory information goes directly to