

REVIEWS AND SHORT REVIEW NOTES

Anna Rauba-Bukowska¹

(Review) Aldona Kurzawska and Iwona Sobkowiak-Tabaka (eds), *Mikroprzeszłość. Badania specjalistyczne w archeologii*. Poznań 2021: Wydział Archeologii, Uniwersytet im. Adama Mickiewicza w Poznaniu.

In recent years, one of the most exciting applications of methods of other disciplines to the studies of archaeological material has been the analysis of ancient DNA (aDNA). The Nobel Assembly at the Karolinska Institutet has recognised this and awarded the 2022 Nobel Prize in Physiology or Medicine to Svante Pääbo for his discoveries concerning the genomes of extinct hominins and human evolution.

In the daily activities of an archaeologist, we do not deal with such spectacular discoveries, but scientific, technological, and IT progress has enabled the construction of sensitive and accurate machines. They make it possible to analyse very small samples and substances from thousands of years ago preserved in trace amounts - *e.g.*, in the walls of ceramic vessels. Thanks to this scientific progress, we can obtain more and more information not only from newly discovered artefacts, but also from those that have been in museums for a long time.

The book “Mikroprzeszłość” (eng. Micropast) is a very interesting work for anyone who professionally deals with archaeology, but also for lovers and enthusiasts of this field of science. In twenty-one chapters, it introduces us to the most important scientific specialities used to analyse historical material. The book’s editors, Aldona Kurzawska and Iwona Sobkowiak-Tabaka, inform the readers in the introduction that the book emphasises research performed using various types of microscopes, microanalysers and, in general, on analyses at high magnifications. Each chapter includes the scientific basis of a given speciality, research methodology, the advantages and limitations of the methods, and examples of their use in archaeology. At the end of each chapter, there is rich literature.

¹ Institute of Archaeology and Ethnology, Polish Academy of Sciences, Ślawkowska 17, 31-016 Kraków, Poland; annaraubabukowska@gmail.com; ORCID: 0000-0002-6653-3614

Most of the specialisations mentioned in the book are sciences that have developed through their close relationship with the study of historical material. These are the sciences used as standards in research on 1) the reconstruction of the ancient environment, 2) human activity in prehistory, and 3) the interrelationships of prehistoric populations.

The book can be divided into two parts. The first 11 chapters are devoted to the analysis of the remains of animate nature. The book's second part deals with the scientific disciplines dealing with inanimate nature.

The first chapter on "Palynology" by Piotr Kołaczek, Monika Karpińska-Kołaczek, Sabor Czerwiński, Katarzyna Marcisz and Mariusz Lamentowicz presents the basics of science dealing with the identification and analysis of plant pollen. These analyses make it possible to precisely reconstruct the vegetation of forests and open areas in the vicinity of archaeological sites at the time of use of the site by humans. It is also possible to make indirect conclusions about the climatic and hydrological conditions. At the same time, the authors pay attention to the issue of correct sampling methods so that the analysis gives the best results.

The chapter by Magdalena Moskal del-Hoyo presents the basics of "Archaeobotany". It is a science created at the junction of two fields: archaeology and botany. It allows us to learn the history of the use of vegetation in each area. Scientists identify plant remains obtained from archaeological sites. This research enables us to learn about flora associated with functioning a given type of site, for example, a permanent settlement camp and a cemetery, and to recognise human-plant-environment interactions. The author of the chapter devoted more attention to anthracological materials due to her speciality. She also drew attention to the importance of taxonomic identification of charcoal fragments before submitting them for ^{14}C dating.

The next chapter, entitled "Dendroarchaeology", was devoted primarily to dendrochronology, and Henryk Dąbrowski presents the details of this issue. The methodology of this field of science is explained in detail. Dendrochronology has permanently entered the scope of specialist analyses in archaeology and allows the dating of artefacts made of wood with accuracy to the year. The principle of this analysis is based on the observation and measurement of annual growth rings of trees. It is also used to calibrate radiocarbon dating results. At the end of the chapter, the author presented the most important possibilities and limitations of this research method.

The author of the next chapter is Monika Chodkiewicz, and it deals with diatom microfossils. Diatoms are single-celled plants that belong to the most common groups of algae, the occurrence of which is associated with the presence of water. Diatoms provide information about the conditions of existing water reservoirs today and in the past. Diatoms respond to changes in oxygen, PH and organic matter in the water. For this reason, they are used as bioindicators, and changes in the species composition of the diatom flora are often used as the basis for reconstructing changes in environmental conditions that occurred in the Holocene after the ice sheet retreated. Diatoms provide information about

the geographic environment of past societies and facilitate the interpretation of complex relationships between culture and environment. Diatom analysis can also be used to determine the origin of archaeological artefacts (*e.g.*, ceramics) or to understand the different functions of some archaeological structures, for example, wells. The author points out that this type of research is rarely used in archaeological studies despite the significant research potential.

Izabela Zawiska presented the issue of the analysis of subfossil Diplostraca ('water fleas'). Diplostracans are freshwater planktonic crustaceans. These animals are one of the main components of freshwater plankton. About 600 species have been recognised and they live on almost all continents. Individual species differ in structure, but all are covered with a chitinous shell. The remains of diplostracans are preserved in lacustrine sediments and can be identified to the species level. Diplostracans are very sensitive to changes in the environment. The analysis of the species composition of diplostracans from the sediments makes it possible to assess changes in water fertility and, combined with the results of the palynological analysis, allows us to conclude whether these changes were the result of human activity. As a result, the study of diplostracans remains is a good tool for reconstructing environmental changes, particularly the impact of human activity on the environment.

Marcin Kadej, Szymon Konwerski and Agata Hałuszko are the authors of the chapter entitled "Archaeoentomology". This specialisation is on the borderline of archaeology and entomology. The authors introduced the reader to the information potential of this type of research. This speciality is not yet very common during standard archaeological research. However, the authors emphasise that it is becoming increasingly popular, and many communications and papers appear at international scientific conferences. The methodological basis is mainly based on entomology. In addition, they pointed out that microscopic techniques are the essential work tool of entomologists and archaeoentomologists. They allow for the identification of materials and their assignment to individual taxonomic units. Precise determination of insect species and knowledge of their ecological preferences makes it possible to learn about ancient communities' living conditions and diets.

A chapter prepared by Aldona Kurzawska presents archaeomalacology to the reader. This speciality, in turn, is a combination of archaeology and malacology, the branch of science dealing with molluscs. Archaeomalacology studies mollusc shells from archaeological sites. Shells or their fragments at archaeological sites can occur in different contexts, *e.g.* shells brought to the site by man and used as a raw material for the production of ornaments; shells as a source of calcium carbonate; shells dumped after eating, *e.g.* oysters; natural accumulation of shells. Various types of microscopes are used to study shell remains. They allow for the identification of all micro-traces created from the moment of obtaining the object by man through modification, use and deposit. Archaeomalacological analyses support archaeologists through detailed specialist analyses of artefacts made of shells.

The malacological analysis in archaeological research is supplemented by isotopic analysis of carbonate shells of freshwater molluscs. This issue was presented in the chapter entitled “Stable isotopes of carbon (δ^{13}) and oxygen (δ^{18}) in archaeomalacology” by Karina Apolinarska. The use of isotopic analysis of shells of freshwater molluscs is multifaceted. It allows us, for example, to determine environmental conditions and their variability over time, which is the environmental background for studying the living conditions of ancient people. The values of carbon and oxygen isotopes recorded in successive increments of the shell provide information about the seasonal variability of environmental conditions. The information recorded in fossil shells is a source of information about both long-term climate changes and seasonal variability of weather conditions. The author draws attention to the potential of isotopic studies of freshwater mollusc shells, which are less used than the study of marine mollusc shells.

Archaeozoology deals with accurately describing the animal remains found in archaeological sites. Jarosław Wilczyński presents this scientific discipline. This field's main task is identifying bone remains and explaining the formation of specific traces observed on the osteological material. The result of the analysis is the acquisition of information that is the basis for reconstructing the behaviour of ancient human communities, allowing us to know and understand their social organisation, economy, diet or religion. In addition to an interesting presentation of the standard methodology of archaeozoological research, the author introduced the issue of fossil DNA research, isotopic research of animal bones and the possibility of examining the age and season of death of the animal. In summary, attention was drawn to how much important information is provided by the analysis of animal bone material - for example, regarding hunting strategies used in the past, methods of managing livestock herds or functions and spatial organisation of the examined sites.

Physical anthropology has been for a long time collaborated with archaeology. The authors Dorota Florkiewicz-Muszyńska, Julia Sobol, Wojciech Kociemba, Anna Hyrchała and Mariusz Glapiński presented the fundamental issues concerning this field of science and its cooperation with archaeology. They explain the possibilities of modern methods of bone material research, including computer tomography, cone-beam tomography, digital radiography and microscopic techniques, for example, optical, stereoscopic, electron microscopy, and scanning microscopy. They note that bone material research could also be carried out at the molecular level – for example, DNA research. Some of these methods are still underestimated or rarely used, for example, microscopic analysis of thin sections of bone elements. An interesting subchapter is the presentation of medical imaging methods in anthropology. The result of such imaging is a reconstruction of the facial appearance based on the skull.

The introduction of this review mentions genetic research of human bones, and the chapter by Maciej Chyliński brings the reader closer to this issue. Archaeogenetics deals with the genetic analysis of prehistoric bones, *i.e.* the so-called fossil DNA (ancient DNA). Research on aDNA requires appropriate equipment, knowledge, reference databases and

adherence to restrictive laboratory standards. The tests are carried out in so-called clean laboratories, separate from the laboratories dedicated to researching modern DNA. Thanks to such research, it is possible to obtain precious information, for example, about former populations or the social structure in individual cemeteries. The author also draws attention to many problems with interpreting the obtained results. At the same time, he points out that this field is developing extremely dynamically; the database is growing exponentially, the costs of DNA sequencing are decreasing, and the resolution of these data is increasing. This allows the verification of various research hypotheses, but there is a need to adapt the formulated questions to the availability of research material. I find this chapter to be the most useful. It allows people who do not have a physical education to get acquainted with the subject, making it possible to understand published research results.

From this point in the book, the chapters on the disciplines related to the Earth Sciences begin.

The first in this series is the chapter on Micromorphology written by Karolina Leszczyńska and Michał Jankowiak. Micromorphological methods analyse a broad spectrum of soils and unconsolidated sediments. Both natural and anthropogenic processes are studied and described. Undisturbed samples in the form of monoliths or thin sections are analysed. This method is used to study, for example, the genesis and evolution of soils, climate change or chronology. The authors present the methods of sample preparation, testing, and the presentation of the results. A proposal for how to describe thin sections has been submitted to help organise and compare them. Analyses of this type should be supplemented with additional tests, for example, fluorescence analysis, reflected light analysis, X-ray fluorescence spectroscopy (XRF), X-ray micro-computed tomography scanning, micro-CT scanning, gas-chromatography (isotope ratio) mass spectrometry (GC-(IR)MS).

Piotr Gunia and Ewa Lisowska presented a chapter entitled “Petroarchaeology”. It deals with the research of rock and mineral resources. The purpose of the petrographic analysis of artefacts is primarily to determine the material the analysed object was made of. Then, attempts are made to determine where the rock was extracted. The primary tool of the petrographer in identifying rocks is an optical microscope under which a thin section made of stone is examined. Other analytical methods also are beneficial, for example, XRD, DTA, SEM and methods for analysing the chemical composition such as XRF, INAA and LA-ICP-MS.

One of the essential stone raw materials in prehistory is the subject of a chapter entitled “Silica raw materials – research opportunities” by Iwona Sobkowiak-Tabaka. The author discusses the most critical issues related to the absolute dating of artefacts and identifying places where flint raw material was obtained. Methods of geochemical and palynological research and organic remains preserved on flint artefacts were also presented.

The author of the next chapter entitled “Traseology” is Katarzyna Pyżewicz. During traseological research, macro and microscopic observations of flint and bone artefacts are carried out. They make it possible to determine, among other things: what techniques

were used in the shaping of tools, what function a given artefact performed, what physical actions were taken with the use of tools, and what kind of raw materials were processed with given specimens. This is now a method widely used as a standard in the study of lithic artefacts.

The next chapter presents methods of testing ceramics. The chapter by Piotr Gunia, Marta Krueger and Ewa Lisowska is entitled “Ceramics – petroarchaeological research”. The authors comprehensively present the methodology of research on ceramics on a microscopic scale. The essential methods of instrumental research are presented. They also give examples of the most important applications of this research and analysis during work on historical material.

The chapter entitled “Ceramics – research on organic deposits inside vessels” presents the scientific basis and methodology of research on organic residues in ceramic vessels. Marta Krueger points out that modern laboratories offer a huge cognitive range. There is also a large variety of substances that can be recognised. Therefore, already at the stage of constructing scientific projects, it is worth specifying research questions to select the best analytical methods. Analyses can be broadly divided into microscopic and molecular. It is possible to detect burnt plant remains stuck to the surface of ceramics, but also substances that have been preserved in trace amounts in the vessel walls, *e.g.* proteins, carbohydrates, alkaloids, alcohols, tar, and lipids.

In the chapter entitled “Textiles”, Maria Cybulska and Anna Drażkowska presented the issue of studies and research on materials made with textile techniques. Fabrics, carpets, and other materials, *e.g.* strings, ropes, laces and knitted fabrics, are tested. Microscopic observations make it possible to identify and determine the numerical characteristics of each type of textile. They also allow the estimation of the degree of damage and the intensity of their contamination. Optical microscopes, scanning microscopes with an EDS attachment, and X-ray microtomography (micro-CT) are standard.

“Archaeometallurgy” by Marcin Biborski and Mateusz Biborski presents methods of researching metal artefacts. They can be generally divided into two directions: the archaeometallurgy of iron and archaeometallurgy of non-ferrous metals. Research issues are primarily an attempt to recreate the technology of making metal objects and identify the centres of production of these objects. The authors presented the most exciting research results, including recent research on ‘Szczerbiec’, the coronation sword of the Polish Kings and the famous Zygmunt Bell in the Wawel Cathedral.

The last two chapters present the use of microscopes in archaeology by Piotr Gunia, Ewa Lisowska and Aldona Kurzawska, and the use of a hand-held X-ray fluorescence (XRF) spectrometer by Michał Krueger.

In summary, the book “Mikroprzeszłość” is a much-needed work that allows the reader to become acquainted with the basics of the sciences cooperating with archaeology.