

Chemical traces of human activity in caves of Polish Jura. Use of selected lipid biomarkers analysis and PAHs analysis in sediments from archaeological sites.

Caves were always a place of interest for humans. Stable conditions inside the caves, i.e. constant temperature or humidity, lead to good preservation of organic matter, including chemical compounds that can be used for specialistic analyses. For archaeologists, especially those dealing with the most ancient history of mankind, they are a unique source of information about the life and activity of people in the past.

Over the last years, there has been a clear progress in methods for analysing cave sediments from archaeological sites: methods of obtaining human DNA from sediment were developed, and palynology (pollen analysis of plants), anthracology (analysis of charcoal) and micromorphology (analysis of properties and components of soils / sediments) became the standard methods used in interdisciplinary projects concerning the past. However, **our knowledge of human presence and activity in caves is still incomplete, and the potential of biochemical methods in archaeology is not yet fully explored.**

The aim of this project is to investigate the possibilities and limitations of the analysis of selected lipid biomarkers and polycyclic aromatic hydrocarbons in sediment samples from cave sites to trace human activity from the Middle Palaeolithic to the present day.

Lipids selected for this research are so called **faecal sterols and bile acids**, which are found in animal and human faeces. Sterols are an important structural component of cell membranes; for example, in animals the most important sterol is the cholesterol. These compounds are absorbed with food or produced in the body, where they are metabolized and then excreted from the body along with the faeces. On the other hand, bile acids are produced in the digestive system, and excreted with sterols. The content and proportions of sterols and bile acids depend on diet and metabolism (digestion and assimilation) and therefore differ between animal groups (ruminants, like cattle, differ in their diet from carnivores, and therefore differ in sterol composition). The project is founded on the assumption that, based on the content and proportions of particular sterols and bile acids, it is possible to distinguish traces of human and animal faeces in sediments.

The second group of compounds under investigation are **Polycyclic Aromatic Hydrocarbons (PAHs)**, which are products of fire. Nowadays, these compounds are one of the indicators of air pollution. In archaeological research, however, they can be used to identify traces of fire and the intensity of its occurrence over the centuries. Although both described methods have been used in archaeology for years, they are rarely used at cave sites.

The research will be conducted on samples obtained from 9 cave sites from the Kraków-Częstochowa Upland (Poland): **Ciasna Cave, Sąspowska Zachodnia Cave, Łabajowa Cave, Bramka Shelter, Shelter in Smoleń III, Biśnik Cave, Koziarnia Cave, Shelter in Krucza Skala and Łokietka Cave.** Human activity in these sites is dated from Middle Palaeolithic up to recent times.

The results of the laboratory analyses will be linked to the results of archaeological, paleoenvironmental and palaeontological studies available for selected caves. The aim of the project is **to determine the possibilities to use the selected methods in research at cave sites and to answer the questions:**

Can analysis of sterol, bile acids and PAHs confirm the presence of humans in caves in a given period?

Do they allow recognition of intensity of past human settlement in caves?

Are these methods useful for the study of sediments from several dozen or several hundred thousand years ago?