

## **Isotopic paleoecology of mid-sized carnivorans (*Vulpes*, *Martes*, *Meles*, *Felis*) during Postglacial within the Polish territory – the history of adaptation to environmental changes caused by anthropopressure**

In paleoecology of mammalian carnivores the major attention is given to large species, like brown bear, wolf and lynx. This is due to strong impact on ecosystems they cause as apex predators, but also high rate of extinction in contact with anthropogenic factors. Large carnivorans are viewed by human as a source of fear and physical threat. The psychology also plays an important role, as large carnivorans were always perceived as dangerous and strong, awakening fear but also adoration. For this reason, they became the subject of special interests, and human fears were the reason for their persecution throughout Europe. The situation is different in case of smaller carnivorans, such as foxes, wildcats, badgers or martens. Although they outnumber the large predators by the quantity of species and ecological diversity, only little attention has been given to their role in past ecosystems, and the history of their adaptation to the environment changed by man, despite their large geographical spread and commonness in fossil material, including the geological record of Postglacial in Poland.

The Postglacial period (since the disappearance of the ice sheet of the last glaciation till modern times, approximately the last 15,000 years) was characterized by significant environmental changes. At first, by strong climatic turnovers – from the periglacial conditions related to the occurrence of steppe-tundra, to the warm climate and development of forests. During this period, the important changes in human economy took place – hunter-gatherer communities of the Final Pleistocene and Early Holocene were replaced with agricultural cultures, and later with the industrialized ones, which have an increasing impact on the natural environment. The growth of the human population, the development of densely populated centers, the introduction of domesticated animals and plants, and the introduction of new ways of using the landscape (especially agriculture and pastoralism) have influenced the ecological balance. Human impact on the environment during the last several millennia caused visible changes in the native fauna, including the limiting of habitats of some species or eradicating the others.

The history of adaptation of the mid-sized carnivore mammals to environmental changes that occurred in the Postglacial period is still poorly understood. Nevertheless, this knowledge is essential not only for the purpose of scientific reconstruction of the history of species. It is also crucial for understanding how these animals react to a specific environmental changes induced both by natural and anthropogenic factors. This will allow for a better assessment of the current and future threats and more effective actions to protect these animals and their habitats.

The methodological basis of the project is the analysis of stable isotopes of carbon, nitrogen and sulfur in bone collagen of fossil remains from archaeological and paleontological localities in Poland. Stable isotopes are used as an important tool in study on the paleoecology of extinct animals. Thanks to this method we can reconstruct dietary habits and ecological niche width for species that are no longer present in recent environments. Stable isotopes offer a number of analytical and interpretative advantages. The classical methods of dietary studies of wild animals are based on the analysis of food remains in scats or stomachs. However, this method has two major limits: some amount of food remains cannot be identified, and food remains represent only the last meal of the animal. The use of stable isotopes offers a precise detection with use of chemical method, and show the average diet during the whole lifetime of the animal. And what is more important, this method allows the study the diet of past animals, which remains only in a form of fossil bones, as the isotopic composition of bone can be preserved unaltered for the millennia.

The project leader, Dr. Magdalena Krajcarz, is a biologist and an archaeologist. Through working in archaeological and geological institutions, she has gained an experience in combining zooarchaeological and biogeochemical techniques, which allows for a comprehensive insight into the history of life of past animals using an interdisciplinary research methodology.