„ Fungi as a source of novel biomarkers in the sedimentary organic matter”

Description for the general public

The fungi kingdom is the second largest group of eukaryotic organisms (organisms whose cells have a nucleus enclosed within membranes). Modern fungi commonly occur in very diverse ecosystems, although they definitely dominate in terrestrial environments. Fungi are also known from the fossil record (for example, the oldest ascomycetes were already present in the lower Devonian, more than 400 Ma years ago), although in this case the knowledge about paleo-fungi is very random, mainly due to the rarity of this type of fossils. Particularly little is known about the role of fungi in the formation of organic matter (including coals), and what 'chemical' traces (so-called biomarkers) were preserved.

In this project an attempt will be made to find an answer to the question, what was the role of fungi in fossil environments and what group of chemical compounds present in sedimentary organic matter come from fungi? Preliminary research results have shown that some organic compounds of fungal origin (e.g. trehalose, mannitol and arabitol) may be present in rocks as dominant polar compounds.

The aim of the research is to find other biomarkers, which can be treated as fingerprint from fungi preserved in terrestrial or transitional environments. The only important condition is immature organic matter character and lack of secondary processes like biodegradation or oxidation. Such compounds can be for example perylene precursors. Perylene is treated as a biomarker genetically linked to wood-degrading fungi which formed at a relatively early stage of diagenesis. However, its precursors were never discovered in sedimentary organic matter. Other compounds expected in ancient organic matter are polar triterpenoids, such as ergosterols, lanosterols or inotodiol. These compounds have not been found in rocks older than Holocene. Moreover, we are going to compare compounds identified in modern mycorrhizal and wood-decay fungi with that present in Mesozoic and Cenozoic sediments.

In addition, simulations of diagenesis using reference standards and immature sedimentary rocks will be carried out in order to trace the pathways of transformations of the primary compounds present in fungi. The main reason for undertaking the described research topic is the lack of satisfactory explanation how fungi contributed to the accumulation of organic matter including coals and black shales. The project sheds new light both on the preservation state of organic compounds of fungal origin and on the recognition of their transformation products, which can be formed as a result of diagenetic processes.