

The Devonian deposits of the Holy Cross Mountains have been the subject of intense paleontological and geological research for over a two hundred years. Deep-core drilling is one the best methods to obtain rock samples when rock formations are not exposed on the land surface, exposures are inaccessible for sampling, or they are destroyed. Palynological and geochemical analyses will be conducted on collected drill cores, which were drilled in two different areas with different geological history. The first study area is the Kielce region of the Holy Cross Mountains; two drill cores will be obtained from this region: Kowala 1 and Zaręby IG 2. The second area is the Radom-Lublin region; five drill cores will be sampled from this area: Szwejski IG 3, Niesiołowice IG 1, Gielczew PIG 5, Krowie Bagno IG 1 and Korczmin IG 1.

Despite the fact that the Devonian deposits (Givetian and Frasnian) were the subject of much scientific research, there is still a lot of gaps in our knowledge. Those gaps may be filled using palynology. Palynological investigations have only been applied to a limited extent in the Givetian and Frasnian deposits of the Holy Cross Mountains and Radom-Lublin area. This method uses different kinds of acids in order to extract microfossils from the rock. These fossils include marine (e.g. phytoplankton, animal remains), fresh-water (e.g. algae) and terrestrial (e.g. spores, plant remains) organisms, which allow us to establish the age of the investigated rocks and to describe the environment at the time of deposition. We are able to categorize particular organisms into genera and species through analysing the entire microfossil assemblage. This allows us to estimate the age of rocks (some of the assemblages only existed for a short period of time in the geologic record) and also allows us to reconstruct the past environment of the investigated organisms.

We aim to integrate palynological analysis with geochemical data. Geochemical data will be provided for the same rock samples obtained from the aforementioned seven drill cores collected from the interval dated as Givetian and Frasnian in age. None of the mentioned drill cores were the subject of the palynological investigation in the Givetian/Frasnian interval prior to this study, with the exception of drill core Gielczew PIG 5. Our project will lead to more precise dating of the investigated deposits, which is integral to understanding the Middle and the Late Devonian in the study areas. It will be also possible to compare the data between the two study sites, and to understand the changes occurring in the environment on a regional scale as a result.

Moreover, the palynofacies analysis will improve our understanding of the Devonian ecosystems, as phytoplankton are at the base of the trophic chain of the marine realm. The distance of the paleo-shore line, the energy, and the oxygenation conditions of the studied basin can be estimated as a result of this analysis. Furthermore, the analysis of the microfossil assemblage (especially the analysis of the total number of the land, marine and fresh-water origin organisms) will allow us to better understand eustatic processes (sea-level changes). Microorganisms are an important source of information regarding global biotic events as they preserve a geologic record of these events from the base of the trophic chain.

Geochemical analyses will also be conducted to supplement the palynofacies analysis. Using geochemical data, it is possible to determine the origin of organic matter (land-derived or marine), estimate the amount of oxygen in the environment, and predict the volume of primary production. This kind of investigation has never been done before in the Radom-Lublin area.

The expected results should significantly expand the existing knowledge on the Givetian and Frasnian deposits from the southeastern Poland. They will also help to resolve important stratigraphic and palaeoenvironmental issues