

The planned project research is to determine the climatic conditions that prevailed around 250-130 thousand years ago in the area of the Tatras and the Low Tatras. We have decided to study speleothems due to their usefulness during reconstruction of paleoenvironmental conditions. One of their characteristics is that they have relatively high growth rate (most speleothems grows from 0.001 to 10 mm per year). The cross section of a speleothems reveals a sequence of layers, laid down over time. And each layer "contain" informations about climate conditions, such as: temperature, amount of rainfall, the intensity of vegetation, prevailing during its growth. Those climate informations can be gather from speleothems through examining oxygen and carbon isotopes, trace elements or different microscopic features. With enough high-resolution sampling, it is possible to trace differences in those parameters and, based on that, inference about climate change occurring in the analyzed geological time. And what is very advantageous, using the modern methods and research equipment, we can obtain more accurate informations, even with a resolution of up to 1 year.

The period from about 250 to 130 thousand years ago was a time of intense climate change. It covers the transition from the warm interglacial to the penultimate glaciation on Polish territory. We decided to reconstruct the climate of that period for several reasons. In our archive of samples we have already speleothems, which was were crystallizing in this period of time, what was confirmed during preliminary dating using alpha spectrometry. The existence of these speleothems is very interesting from a scientific point of view, because usually glacial periods are accompanied by the cessation of speleothems growth, mainly due to a low temperature. The detailed reconstruction of that past environmental conditions will help to determine how the colder period influence on the speleothems and also indicate which factors had the greatest impact on the mechanism of crystallization of speleothems. At the same time a period of such rapid climate change can provide important data for comparison and analysis with the currently observed climate changes.

As mentioned above, a large part of speleothems we already have in our archive and they are available for study, but the full realization of the set objectives will require further field work and collecting additional samples from The Brestovská Cave and The Demänovská Cave System. Then the speleothems will be cut by water jet cutter along the axis of their growth into several layers. They will be also carried out preliminary dating. If the obtained time of crystallizations of that speleothems will cover 250 to 130 ka, different layers will be used to perform detailed analyzes.

The primary research problem in the analysis of speleothems is their accurate dating. It will be used for this purpose the U-series dating method, which we already use for many years, and the mass spectrometer measurements. In subsequent steps we are going to study:

- stable isotope and trace elements analysis along the profiles of selected speleothems;
- calcite fabrics analysis;
- construction of the time scale for individual records and placement on these time scales all obtained paleoenvironmental proxies.

Then, the obtained results will be compared with other paleoclimate records from that period, including the data obtained from ice cores, pollen analysis, and marine sediments. All that gathered paleoclimatic data will enable to carry out a thorough interpretation of our results (isotopic and trace elements charts, petrographic profiles etc.) and to draw conclusions about the climate conditions in the analyzed period.

In recent years, research focusing on climate change are intensively conducted by many research centers around the world. More and more often extreme weather events, rising sea level and global warming itself draws attention not only scientists on issues related to the analysis of currently taking place climate changes, and also their projection into the future. For these purposes very helpful are paleoclimatic studies, because the majority of current climate changes have their counterparts in the geological past. Accurate investigation and analyze of that past variability of the climate will result in better understanding the current processes, and also will provide important ground truth for the models and can lead to improved model simulations of future climate.

We conduct paleoclimatic research at our Institute for many years with numerous successes, including publications in international journals. Further benefits of our previous studies are: the fact that speleothems for paleoclimate research are easily accessible for us, we also gain necessary experience and the possibility to work on the modern equipment used to carry out that type of measurement. In our laboratory we have also developed specialized software for post-processing of results and very helpful when climatic interpretations. In summary, we have the right capabilities to successfully conduct research on the reconstruction of paleoclimate conditions for a period of about 250-130 ka in the area of the Tatras and the Low Tatras. And as a result of these works we can provide many important paleoclimatic data and increase our knowledge about climate changes and its possible effects.