CO-FACTOR: **C**ontrols **O**n **F**oraminiferal c**A**rbon **C**ontribution **TO** **E**uropean **AR**ctic **S**ediments.

The carbon element is unique. It is found in the air, in the water, in rocks, in ourselves, and in every other living organism. It is also an element shaping the climate of the Earth, as carbon dioxide is one of the greenhouse gases that determine the atmospheric temperature of our planet. Small changes in one element of this cycle can drive significant feedbacks. Throughout Earth's history, there have been situations where such changes (e.g., increases in algal populations, volcanic eruptions) have disrupted other elements of the carbon cycle in an avalanche-like manner. It resulted in fluctuations in temperature, changes in the distribution of organisms, increase/decrease in rock formation, as well as alterations in the properties of ocean waters. These are just some of the reasons why the carbon cycle is currently the focus of global scientific attention.

One of the elements of the carbon cycle are the inconspicuous foraminifera. These marine organisms are rarely larger than a grain of sand. Foraminifera evolved 500 million years ago and have since become an integral part of the carbon cycle. This is because they possess very resistant calcium carbonate shells. Additionally, during the shell-formation process foraminifera produce carbon dioxide. Despite their small size, these organisms can reach very large populations. The abundance of planktonic (living in the upper part of the water column) foraminifera is so high that they account for about half of the annually deposited calcium carbonate on the ocean floor. In the geological past, there have been periods when enormous quantities of foraminifera accumulated on the seafloor, forming rocks. It is these rocks that humanity has utilized for the construction of pyramids in Giza or buildings in the historic districts of Paris ("Lutetian limestone" buildings).

In our project, we focus on the recent history (the last 14,000 years) of foraminifera, and their role in the carbon cycle in the European Arctic region. Marine sediments off the coasts of Norway and Svalbard contain enormous quantities of foraminifera (even thousands of individuals per gram of sediment!). Additionally, foraminiferal shells are exceptionally well-preserved in the delicate glaciomarine sediments of this region. By collecting long sediment cores in several key areas of the European Arctic, we will be able to study changes in the abundance and species composition of foraminifera. Furthermore, we will subject the foraminiferal shells found in the sediments to a series of analyses. Thanks to these analyses we will be able to reconstruct the conditions in which foraminifera lived. We'll also study how changes in environmental conditions affected the well-being of foraminifera by analysing their morphology and shell thickness with the help scanning electron microscopy. We'll not only study foraminifera, but also the sediments in which they live. We'll examine the distribution of particle sizes of sediments, their elemental composition, presence of various compounds, and their magnetic susceptibility. Through this approach, we will be able to reconstruct the environmental conditions (temperature, salinity, oxygenation, ice presence) in which the foraminifera lived, as well as the quantity and type of food available to them. Additionally, we will thoroughly examine how changes in these conditions influenced the amount of carbon buried in the sediments in the form of foraminiferal shells. When foraminifera die, most shells remain on the seafloor and become covered by subsequent layers of sediment. This buries carbon in the sediments for thousands and even millions of years. It means that unfavourable environmental conditions for foraminifera (e.g., inadequate temperature) will increase the amount of carbon in circulation, what could impact the Earth's climate. Thanks to our innovative approach that combines the study on foraminifera, sediments, and carbon, we will gain a better understanding of the changes in the environmental conditions of the European Arctic over the past 14,000 years. We will also learn how the ongoing climate changes can affect the long-term carbon cycling, a fundamental process affecting the Earth's climate.