The anthropogenic emission of carbon dioxide CO_2 is the most important element of contemporary climate change. Oceans act as an important carbon sink absorbing approximately 24% of such input and acting as "our protection" against progressive climate change. However, the rapid increase of anthropogenic emissions causes so much CO_2 to dissolve in oceans, that elements of the marine ecosystems begin to have the negative effects of this. The reaction of the aquatic environment to the increased amount of CO_2 is decreasing seawater pH and consequently a reduction of $CaCO_3$ saturation state, on the basis of which marine calcifiers build skeletons. Thus, climate change has a great potential to alter the calcification rate, composition and ultrastructure of skeletons, even leading to their destruction.

Among marine calcifiers are invertebrates such as clams, snails, corals, starfish, sea urchins, bryozoans, brachiopods and foraminifera, all based on the ability to form calcareous skeletons. They occur globally in almost every environment, at any depth and latitude and are represented by both, benthic and pelagic species, being undoubtedly a key element in the ocean biogeochemistry and functioning. The distribution of calcifying fauna in the ocean strongly depends on the prevailing environmental conditions, which are rather stable, and even a small change can be of great importance for the marine organisms. Therefore, supplying the anthropogenic CO_2 into ocean masses disturbs the balance and has to be considered as a significant threat to the persistence of species and the biodiversity of ecosystems.

If the current trends in CO_2 emissions continue in the future, we can expect ocean waters to become detrimental to calcifying organisms, causing their skeletons to dissolve. Yet, the biological response to climate change may vary within and among species, genus and families, being far from full understanding. One of the fundamental questions concerning the biomineralization is the extent of environmental against biological control over the structure and composition of calcareous skeletons, which determines their properties, e.g. solubility. The mineralogy and geochemistry of skeletons are highly variable and the understanding how much environmental conditions control their production is still insufficient and in the era of climate change – essential. Organism can acclimate and/or adapt its physiology and behaviour to keep environmental niche, can shift its occurrence to another and better suitable area (if it is able to move), or a modified climate can prevent its survival.

Therefore, the major purpose of the presented project is to reveal how seawater chemical factors influence the production of $CaCO_3$ skeletons and what is the survival potential of calcifiers in the face of climate change. To achieve that, we propose to investigate the variability patterns of structure and composition of bryozoans' skeletons along the seawater $CaCO_3$ saturation gradient. The decrease in seawater $CaCO_3$ saturation state, that naturally occurs when the seawater depth increases, will be used as an analogue of the loss of dissolved CO_3^{2-}, occurring when the atmospheric CO_2 is intensively absorbed by oceans. Conducting the research in the depth ranging approximately from ~ 10 to 5000 m will give an opportunity to search the skeletal structure and variability above and below the compensation depth, thus means in over- and undersaturated conditions with respect to $CaCO_3$. Such a vertical layering of the physicochemical properties of seawater acts that the skeletal variability along the strong depth gradient could be a scenario for the impact of climate change on the shallower ecosystems. The assumption is that if the skeletal features are phylogenetically controlled, rather than environmentally, the externally changing environment will have lower impact on the survival of species.

We are going to expand the discussion to an interdisciplinary approach, combining extremely important fields in the context of the effect of human-induced CO_2 on calcifiers. i.e. mineralogy (e.g. calcite vs aragonite), biogeochemistry (e.g. trace elements is skeletons) and phylogeny (e.g. relationships between individuals). A strong aspect of our research is also the structural checking if there are already signs of destruction of skeletons along the natural $CaCO_3$ saturation gradient, including undersaturated conditions. For the first time, results concerning the complex analysing of the structure and composition of skeletons precipitated along the $CaCO_3$ saturation gradient, as the equivalent of rising CO_2, will be presented. This will allow to asses of the impact of human induced climate change on marine biota, that is of considerable value in the management of marine resources and lobbying for reduction in CO_2 emissions. The mineralogical and geochemical characteristics of deep-sea calcifiers will be a priceless contribution in the field of biomineralization, which despite intensive research, still raises many questions. The project will be conducted in environmentally complex region, so will allow us to generate predictions for other marine locations, including different latitudes.