In the times of climate changes and strong anthropogenic pressure on the environment, the topic of seawater acidification is getting more explicit. There are numerous processes that may influence the acid-base system of seas and oceans on a larger or smaller scale. The main large-scale process which may lower the pH of seawater is the CO_2 dissolution from the atmosphere. Also, the decomposition of organic matter, in the course of which many H^+ donors are produced has a substantial effect on increasing the pool of acids in the marine environment. The impact of acidification on the marine environment can be multi-dimensional, ranging from the negative impact on the functioning and survival of marine organisms, especially those that build aragonite and calcite shells and skeletons, through the influence on the speciation of elements and the rate of formation and persistence of minerals, to a reduced ability to further absorb CO_2 from the atmosphere.

Along with the notion of acidification, the word alkalinity also appears. In the context of the marine environment, it is defined as the ability of seawater to resist the changes in pH. Therefore, any variation in alkalinity is the key point when discussing the acid-base system of seawater. While in the open ocean the alkalinity primarily depends on the concentration of dissolved inorganic carbon and borate ions, in the coastal areas it is also influenced by many other substances carried with riverine waters or released from sediments. Consequently, a whole set of different biogeochemical processes which occur in the marine environment of shallower coastal zones should be taken into account when investigating its acid-base system. Bearing in mind that the processes taking place in the water column and having impact on this system (and also on alkalinity) are quite well recognized and described, in contrast to the processes taking place in sediments, we have decided to focus on the latter. Thus, the objective of the proposed project is to investigate the role and quantitative effect of biogeochemical processes taking place in marine anoxic sediments on alkalinity generation in the marine environment.

Within this project, we plan to combine different aspects, i.e. geochemical, microbiological, mineralogical and geophysical to study the processes of alkalinity release from anoxic sediments. We plan to focus on the southern Baltic Sea and conduct the research not only on sediments but also on the seawater column, phytoplankton, suspended matter, and bottom structure, to be able to fully recognize all the dependent factors. Apart from recognizing the physico-chemical conditions in the study area and thorough studies of sediments, including composition of pore waters, minerals in the solid fraction, bacterial/archaeal communities as well as rates of microbial processes in sediments, we also plan to incorporate modelling studies of biogeochemical processes in marine sediments. In order to be able to extrapolate the obtained results on other seawater bodies in the world, in the model we plan to include three separate study areas differing in the geochemical characteristics of the sediment, i.e. anoxic sediment with and without active methanogenesis as well as methanic sediment with freshwater seepage.

The quantitative significance of sedimentary processes for the alkalinity budget is still poorly understood. There is also a significant lack of knowledge how the role of sediments can change in response to coastal eutrophication and acidification scenarios. As there are significant gaps in the present state of knowledge we believe that our studies will allow for the delivery of results and characterisation of processes that enable the re-calculation of alkalinity budgets (taking into account the effects of processes in which alkalinity is generated in different-type anoxic sediments).