Contemporary anthropogenic environmental changes pose many questions for mankind about their causes, course, and effects, especially in relation to climate and biodiversity. Maintaining the biodiversity of marine ecosystems against ongoing anthropopression requires an understanding of long-term dynamics of resilience and adaptive plasticity in the context of global environmental change. Modeling the course of contemporary climate changes is allowed by comparison with biotic crises known from Earth's geological history. A sharp increase in the average global temperature, decrease in oxygenation, and increase acidification of the ocean, decrease in biodiversity, increase in frequency of weather extremes, etc., phenomena observed today, suggest a return to the trajectory of global changes known from the past, especially from the turn of the Paleozoic and Mesozoic. Hence, the Permian-Triassic mass extinction (P/T extinction), ~250 million years ago, is often considered the counterpart of the contemporary changes referred to as the Sixth or Anthropocene extinction. The biotic crisis at the P/T boundary caused extinction of approximately 95% of marine species but had little effect on the taxonomic diversity of bivalves. This is because, potentially, marine bivalves possess adaptability against environmental stress, such as those associated with elevated atmospheric CO_2 concentrations, including increased acidification and hypoxia of marine waters. Fossil bivalve shells, one of the most promising high-resolution archives, store information about this exceptional adaptability, resilience, and/or phenotypic plasticity, and reading them will allow us to understand the extent to which bivalves, and perhaps other organisms, are able to adapt to modern environmental changes.

Environmental signals are recorded in bivalve shells as the mollusk tirelessly, laminae by laminae, precipitates its carbonate calcareous skeleton throughout its life. Sclerochronology and sclerochemistry are based on the study of these regular macro- and micro-growths and their chemical properties, recorded during the lifetime of one or more individuals. The shell growth depends on the biophysiochemical parameters of the environment; hence the successive increments (laminae) precisely reflect the environmental conditions prevailing at the time of their formation. The selective incorporation of elements and isotopes into shells along with the shell banding allows accurate determination of the formation time of the geochemical data points studied, providing unprecedented resolution, even on a daily or hourly scale. Bivalve shells are fossil calendars, daily diaries of Earth's environmental cycles since their first appearance in the early Cambrian 540 million years ago.

Furthermore, bivalve shells record natural rhythms triggered by environmental stimuli (so-called *zeitgeber*), such as daily/seasons or moon cycles/tides, and endogenous (biological) oscillator/clock of living organisms. The latter can free run even when environmental stimuli are removed or changed. Biological rhythms and environmental cycles are usually synchronized. The periodic growth lines in shells can thus preserve at least five different frequencies: tidal, daily, fortnightly, monthly, and annual. However, marine bivalves are characterized by unpredictable, cross-generational phenotypic plasticity, especially with respect to physiological processes, i.e., life rhythms, which can significantly affect the shell geochemical properties.

The subjects of this study are shells of bivalves that survived the P/T biotic crisis while not being significantly phenotypically changed – the Muschelkalk bivalves. The main aim is to decipher the pattern of biological rhythms and/or environmental cycles influencing bivalve development and to understand the major stimuli controlling biomineralization in the Middle Triassic. The results will help answer the question of to what extent, if any, resilience and/or phenotypic plasticity of Triassic bivalves influenced the parameters of environmental cycles recorded in their shells and determine the usefulness of the recorded geochemical signal in environmental research. Geochemical signatures combined with growth rate analysis will allow the identification of biological rhythms and environmental cycles in Triassic bivalve shells. Research methods include microscopic, chemical, and isotopic methods combined with spectral analysis, i.e., FE-SEM, LA-ICP-MS, SIMS. The results will be compared with those from our recent research on modern bivalve shells. The expected result of the research is to point out the survival ensuring features of bivalves that may also be used today to maintain as much biodiversity as possible during rapid environmental change.