The aim of the project is to study the response of gymnosperms (pre-angiosperm floras) to changes in atmospheric CO_2 concentration (connected with temperature) in various parts of Poland in the period from the Late Triassic to the Late Jurassic. During this time there were several climatic fluctuations and changes in the taxonomic composition of floras (thermophilic assemblages alternated with those adapted to cooler climate). Along with topography, temperature is one of the most important factors influencing the appearance or disappearance of plant taxa in a given area, and the type of response of individual taxa indicates their range of tolerance and the operation of adaptive mechanisms of pre-angiospermal floras. The methods allowing detection of changes in atmospheric CO_2 concentration include geochemical analyses of $\delta^{13}C$ isotope content in fossil plant leaves, and analyses of the characteristics of epidermal cells and stomata visible on the cuticle, which can indicate climatic stress. By affecting the efficiency of photosynthesis, climatic stress alters the metabolism of plants. It may cause adaptive reactions or floristic changes, affecting the biodiversity of ecosystems. This stress also has a direct impact on flammability during fires confirmed in the fossil record. The content of ^{13}C in leaves increases as a result of a decrease in atmospheric CO_2 (stress), when during photosynthesis plants are forced to absorb the less easily diffusing ^{13}C component of CO_2. Under optimal conditions (high CO_2), plants use mainly the more easily usable ^{12}C isotope. The ^{13}C isotope is stable; that is, it is stored unchanged in fallen leaves and persists even after fossilization, enabling reconstruction of the conditions in which these plants lived. Negative values of $\delta^{13}C$ indicate climatic stress, while positive values indicate stable conditions. There is also a relationship between CO_2 concentration and plant metabolism, reflected in the dry weight of leaves and observable in the size of epidermal cells. Leaves with high mass have smaller and more closely packed cells. Higher cell density means a state of stress and relatively lower water content, which affects the flammability of a given assemblage.

Another way of determining CO_2 fluctuations is to calculate the stomatal index (SI) and then to use the inverse relationship between stomatal density and atmospheric CO_2 content. Comprehensive application of all these analyses ensures the reliability of measurements and the efficacy of the tests. Our research will cover several sites from the Late Triassic to the Late Jurassic, mainly in southern Poland (spatial changes in vegetation), and drill cores (temporal changes), using material from known plant assemblages and some new material selected for the needs of the project. To determine the changes in vegetation we will also use palynological data. We will compare our results with those obtained in research on climate stress in Greenland confirmed for the Triassic/Jurassic boundary, when strong climatic fluctuations occurred, leading to the changes in the flora.

Our goal is to investigate the intensity of temperature stresses in Poland as a cause of floristic changes. This project would be the last of the series of projects explaining the dynamics of plant changes caused by different factors. In the previous projects we examined the successive variation of ecosystems based on plants, related to topographic changes in the studied areas. The current project will enable us to determine which changes in plant cover within the studied 60 million years in Poland were caused by climatic stress, and which were mainly habitat-related. The universality and accuracy of the above-mentioned research methods will also be evaluated on the basis of the Polish Triassic/Jurassic boundary and subsequent periods showing less drastic changes. We believe that the results of this complex study will contribute to the general methodology of palaeoecology and determination of plant diversity. We will use leaf dry mass analysis and geochemical analyses of charcoal present at several sites to explain natural fire phenomena in terms of the condition of the vegetation and its susceptibility to various types of combustion. In the particularly interesting material from fires in Sołtyków (Lower Jurassic), charred fern crosiers were preserved en masse, suggesting that extensive fern thickets burned; all the plant material represents a similar stage of leaf development, presenting an interesting palaeoecological background.

The obtained data will be shared with the online system of the international *Community Paleo-CO_2* project, which aims to study climate change on a global scale.