

Radiocarbon dating is a method for determining the age of an object containing organic material by using the properties of radiocarbon, a radioactive isotope of carbon. This method is based on the fact that radiocarbon (^{14}C) is constantly being created in the atmosphere by the interaction of cosmic rays with atmospheric nitrogen. The resulting ^{14}C combines with atmospheric oxygen to form radioactive carbon dioxide, which is incorporated into plants by photosynthesis. When the animal or plant dies, it stops exchanging carbon with its environment, and from that point onwards the amount of ^{14}C it contains begins to decrease as the ^{14}C undergoes radioactive decay.

The global average production rate of ^{14}C strongly depends on the intensity of the cosmic ray flux. The production rate of ^{14}C may increase due to extraterrestrial high-energy events, such as solar proton events (SPE), supernova explosions or gamma-ray bursts, which increase the intensity of cosmic rays reaching the upper atmosphere.

The aim of this project is to determine the changes in radiocarbon concentration in dendrochronologically dated annual tree rings from southern Poland, and use these changes to precisely date part of the floating chronology for subfossil pine from the peat bog Puścizna Wielka. This is possible thanks to the Miyake discovery, who first described rapid and short-lasting increases of radiocarbon (^{14}C) concentration in the annual tree rings of Japanese cedar (*Cryptomeria japonica*) between AD 774 and 775 (increase was about 12‰) and of Hinoki cypress (*Chamaecyparis obtusa*) between AD 993 and 994 (increase was about 11.3‰). This sudden increase of radiocarbon has been confirmed also by other scientists. Due to the characteristic of the sharp increase in radiocarbon concentration that occurs in this phenomenon, and due to the global character of this effect, it is possible to use it for accurate dating of annual tree rings, using the radiocarbon method.

A similar increase was observed in 660 BC. In this period is also located the floating pine chronology for southern Poland, which has 491 years, determined on the basis of 125 individual sequences.

This project is planned to analyze the changes of radiocarbon concentration in annual growth rings around 660 BC. Samples from Grabie, a village near Krakow (SE Poland) will be a control series, of known calendar age and known changes of radiocarbon concentration around 660 BC. The values of these changes will be compared with the values noted in samples of pine tree from the peat bog Puścizna Wielka (floating pine chronology) to its precise dating (with an accuracy of up to one year). This will allow the absolute dating of tree rings from floating pine chronology, which has been so far unattainable using the radiocarbon method. It will be one of the first applications of this discovery in absolute dating, which will build one of the longest chronologies of pine trees in central Europe. Furthermore, based on the analysis of changes in the content of ^{14}C radioisotope and the ratio of stable C and O isotopes, we can do reconstruction of paleoclimatic changes in the VII-VIII century BC.