

Study on modifications of water chemistry, limnological parameters under the influence of variable alimentation with cryosphere degradation and pollutants migration in the periglacial environment of non-glaciated catchments in Lions Rump, Antarctica

Currently, there is no place on Earth that has not been (directly or indirectly) affected by anthropogenic activity. The area selected for research (Cape Lions Rump on King George Island in Antarctica) is characterized by (apart from negligible human activity) the presence of permafrost and glaciers. It has been proven that in Antarctica there are present many chemical pollutants, including persistent organic pollutants (POPs), which are found in water, snow, soil, and tissues of living organisms, such as penguins and seals. The presence of POPs in environment is mainly related to human activity, but some of them may have a dual origin: anthropogenic and natural, e.g. polycyclic aromatic hydrocarbons, the occurrence of which is associated, among others, with volcanic events.

The Antarctic permafrost and glaciers over the decades have been the site of accumulation of chemicals naturally occurring or introduced into the environment as a result of local human activities, as well as as a result of global processes such as long-range transport of pollutants in the atmosphere and seawater from areas of the southern hemisphere. The increase in global air temperature contributes to the intensification of degradation processes in areas of permafrost, melting of glaciers and snow cover, and thus also to the re-release of pollutants. Once emitted, pollutants in the Antarctic environment can bioaccumulate in both animals and plants living in the area. Due to climate change, in recent years a wide range of scientists have become interested in the pollution of the polar regions. Previous studies have shown that POPs have harmful properties, e.g. carcinogenic, mutagenic or disruptive to the reproduction of Antarctic animals.

The above-mentioned phenomena, the negative impact of pollution on fauna and flora, the insufficient amount of information in the literature on the environmental fate of POPs in Maritime Antarctica were the main reasons for taking up the subject proposed in the project. In the research area, analyzes of this type (taking into account the concentration of chemical pollutants) have not been carried out so far. In the course of the project, an important achievement will be the improvement of the existing methods of analyzed samples, the application of the most modern analytical techniques and methods of sample preparation to enable the lowest limits of detection and determination of POPs in water collected in Antarctica. The original approach involves a combination of field limnology studies using remotely controlled equipment (to minimize environmental interference) and detailed chemical studies in a single experiment. Antarctic lakes are often overlooked by scientists due to the difficulties associated with collecting water samples from a body of water in remote polar regions (it's necessary to use additional, specialized equipment). The analysis of these waters may be of great importance in the context of the transport of pollutants in the polar environment. The aim of the project is to understand the environmental fate and routes of POPs in Antarctic ecosystems, as well as the interactions between these chemical entities as a result of coexistence in the environment. Taking into account the assumptions of the project, the planned research is to go far beyond the current state of knowledge.

The premise of the project is to analyze the results of a wide range of determinations of chemical compounds, including newly emerging pollutants in the Antarctic aquatic environment. The study area is located on the west coast of King George Bay (South Shetland Archipelago, Maritime Antarctica). Samples of surface and subsurface water from lakes located within three non-glaciated catchments will be collected as part of a project. The levels of compounds concentration harmful to living organisms inhabiting this sensitive environment will be tested, including compounds from the group of polycyclic aromatic hydrocarbons, pesticides, selected metals, non-metals and ions. In addition, on the basis of limnological measurements, e.g. of depth, transparency or the amount of algae in lakes in West Antarctica, it will be possible to estimate the sources of origin of the tested chemical entities and the potential effects of their presence on Antarctic ecosystems. The analysis and interpretation of the results using statistical methods, geological and hydrological analyzes and modeling of pollutant emissions in the study area will be the basis for assessing the environmental fate of the pollutants determined, taking into account the human impact on the study area. The collected data will allow to assess whether the pollution present in this area may contribute to the gradual degradation of Antarctic ecosystems. In addition, unprecedented results form the basis for discussions on tightening the legal provisions for the protection of the Antarctic environment.