

A general description of the project “Relationship of permafrost with geomorphology, geology and cryospheric components based on geophysical research of the Hans glacier forefield and its surroundings. Hornsund, Spitsbergen.”

The cryospheric research belongs to the most priority task of the scientific world. Its components such as glaciers and permafrost constitute important, because very sensitive to climate change, component of the geographical environment. Despite vigorous work carried out in recent years in several scientific centres complicated variability of the cryosphere is still unknown. The Hornsund area at Spitsbergen is a critical place for permafrost research. On this southern part of the archipelago, climate changes rapidly, and the changes may be the greatest. The aim of the project is to determine the area and the depth of permafrost occurrence in the entire space between the mountain ridge and the sea shore of the Hornsund. Its occurrence depends not only on the impact of negative air temperature on the earth surface and its temporal variability, but also on the influence of salty sea-water and the geological evolution of the coastline, visible in the form of uneven-aged marine terraces located on different heights in the area of the Hornsund.

Variation in the extent of glaciation in the study area, especially in the period from the end of the so-called Little Ice Age, also affect the long-term permafrost evolution modifying its temperature and ice content of soil in the foreland of the glacier. Thus, it can be visible that glacial and periglacial environments overlap each-other in terms of material expression: by the presence of ice of different origins in both environments; and also in terms of geophysical by variability in the course of the permafrost limit namely the temperature of 0°C.

In this area of research, a series of geophysical surveys, using electrical resistivity method (ERT), allowing initial assessing of the permafrost extent and its relations with the glacier, as well as the relief and geological structure of the area, has been conducted. However, the use of only one geophysical method in research is not sufficient for scientific certainty. The application of extensive seismic surveys on the very same locations can bring ultimate success of research on permafrost extent in this area. Along with climate information and other direct observations provided, they will constitute a complete set of data. Proposed in the project synthetic and interdisciplinary approach in research of the interdependence of permafrost of periglacial and glacial environment are new in the world scale, introduced into scientific circulation by Polish scientists. The first application of this approach is the research, which was carried out in the study of Storglaciaren in Kebnekaise, Sweden. The development of this approach in the sub-polar conditions of South Spitsbergen will allow not only to recognize the variability in the permafrost distribution but also the approximation of its evolution since the end of the last ice age. This would develop the original Polish research approach allowing to achieve future leadership in the world in this kind of research.