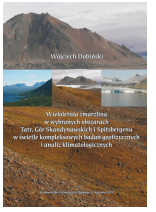
Wieloletnia zmarzlina w wybranych obszarach Tart, Gor Skandynawskich i Spitsbergenu w swietle kompleksowych badan geofizycznych i analiz klimatologicznych

[Permafrost in selected areas of the Tatra Mountains, the Scandinavian mountains and Spitsbergen using comprehensive studies of geophysical and climatological analysis]



Wojciech Dobinski

Wydawnictwo Uniwersytetu Slaskiego, Katowice, Poland, (English, German sum.), illus. incl. sects., 10 tables, geol. sketch maps, 560 ref., 2011.
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Permafrost is the subject of increasing interest to scientists due to its rapid response to recent climate change. Future warming may strongly reduce current extent of permafrost including frozen ground in mid-latitude mountain areas. The Impacts of climate change on permafrost may differ markedly between the subpolar, polar and mid-latitude regions. Detailed knowledge of permafrost state in these zones thus may be critical to anticipate its future evolution. In Poland, the investigation of permafrost and related periglacial phenomena has a long tradition. Since the end of the 19th century, Polish geocryologists have studied permafrost in Siberia, Scandinavia, subpolar and polar regions. Wojciech Dobiński represents the last generation of Polish scientists focused on permafrost. He started his research of permafrost conditions in the Tatra Mountains at the beginning of the 1990ies using geophysical and climatological methods. A number of his studies on distribution, thermal regimes, age and evolution of local permafrost have attracted broad attention of other scientists on mountain permafrost in Poland. In order to improve the description of the conditions and factors which control the evolution of permafrost in the Tatra Mountains, W. Dobiński has extended his work in the Carpathian and Scandinavian mountains recently. Results of comparative analyses and conclusions on the incidence and evolution of permafrost in mid-latitude and subarctic mountains are presented in this study.

The study has a short introduction, three main parts on permafrost investigation and concluding remarks. The first part provides an introduction to general characteristics, distribution and origin of permafrost. The second part contains information about field studies and research results in selected areas. The third part deals with age and evolution of permafrost in the Tatra Mountains and the Scandinavian mountains near Abisko.

The first main part represents an overview of current knowledge of the permafrost phenomenon. It introduces a reader to the definition of permafrost, thermal conditions, age and active layer processes. This part provides a useful knowledge base for non-specialists covering all basic aspects of permafrost system. In this section, the author describes three types of permafrost (periglacial, glacial and subglacial) and gives an overview of mountain permafrost distribution within Europe. The overview is particularly informative as it covers small mountain areas where the climate does not

facilitate the existence of the recent permafrost. The first part ends with a short chapter on the history of permafrost exploration by Polish researchers.

In the second part, the author presents his investigations in the Tatra Mountains, Scandinavia and on Svalbard. The part has an overview of exploration techniques, a short description of study areas and a comprehensive account of research results. At the beginning of the result section, the author presents an analysis of air temperature and considers freezing and thawing indices at study sites. In the following chapters, he presents and discusses the geophysical data used to identify the presence and vertical extent of permafrost. He also provides information on ground temperature recorded at study sites in selected depths. An analysis of potential depth of freezing and thawing illustrates climate warming and increase of ground surface temperature in study areas. The most rapid warming is found in low altitudes and close to the ocean. The second part of the study ends with a consideration of the potential for permafrost preservation. The conclusion is that permafrost in the study areas is likely to prevail in the next decades despite of unfavourable climate conditions.

The third part of the study comprises three sections documenting the age and evolution of permafrost in the Tatra Mountains and in Abisko area, Scandinavia. A geophysical model is used to investigate how permafrost changed in the study sites within the Holocene. Analyses indicate that permafrost has never melted entirely since the last termination and constitutes two layers in different depths. Finally, an interaction between permafrost and glaciers on Svalbard is outlined and discussed. A general thinning of the glaciers leads to a cooling of both glacier ice and the ground below the glaciers. As a result, small polythermal glaciers may become entirely cold-based and permafrost aggradation may propagate. Geophysical data are used to illustrate how periglacial permafrost interacts with glacier environment. The presented data confirm author's concept of permafrost continuum between the two environments.

This study provides a comprehensive introduction to geocryology and gives a good overview of specific topics related to permafrost in the study areas. Although most of the information presented in this study has already been published, it is useful as a synthesis and source of references for scientists interested in cryospheric or geomorphological research in these areas. A number of illustrations and diagrams in the study suggest that it will be relevant especially to geophysicists working in the periglacial environment.

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