Title: Permafrost and Glaciers: Perspectives for the Earth and Planetary Sciences—Another Step Forward

Author: Wojciech Dobiński, Christof Kneisel

Citation style: Dobiński Wojciech, Kneisel Christof. (2021). Permafrost and Glaciers: Perspectives for the Earth and Planetary Sciences—Another Step Forward. "Geosciences" (2021), iss. 11, art. no. 68.
DOI: 10.3390/geosciences11020068

geosciences

MDPI

Editorial

Permafrost and Glaciers: Perspectives for the Earth and Planetary Sciences—Another Step Forward

Wojciech Dobiński [1,]* and Christof Kneisel [2]

[1] Institute of Earth Sciences, Faculty of Natural Science, University of Silesia in Katowice, ul. Będzińska 60, 41-200 Sosnowiec, Poland
[2] Institute for Geography and Geology, University of Wuerzburg, 97074 Wuerzburg, Germany; kneisel@uni-wuerzburg.de
* Correspondence: wojciech.dobinski@us.edu.pl

check for updates

Citation: Dobiński, W.; Kneisel, C. Permafrost and Glaciers: Perspectives for the Earth and Planetary Sciences—Another Step Forward. *Geosciences* **2021**, *11*, 68. https://doi.org/10.3390/geosciences11020068

Received: 16 December 2020
Accepted: 3 February 2021
Published: 4 February 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Permafrost and glaciers are the most important components of the cryosphere. Their mutual relationship has only recently become the subject of interdisciplinary research. The fact that most of the permafrost and glacial studies have been carried out separately is an obstacle to further consistent progress within this scientific field. Moreover, the progressive specialization of research in Earth sciences has led to increasing difficulties with the holistic view of the cryosphere in general. Additionally, the practical issues associated with so-called "climate change" mean that little attention is being paid to understanding the essence of the cryosphere's components and their interrelationships. Thus, there is a growing disparity between the results of empirical, environmentally oriented research and their more precise, universal, and interdisciplinary understanding. The purpose of this Special Issue is, therefore, on the one hand to present the results of empirical studies and on the other hand to refine the synthetic opinions, based on the authors' scientific experience, on how the relationship between permafrost and glaciers should be perceived in their view.

The above idea, as stated in the invitation to this volume, interested the modest number of six authors who published their work in this volume.

Summarizing it, we want to reflect once again on their meaning and the common value they bring under the slogan "Permafrost and Glaciers: Perspectives for the Earth and Planetary Sciences".

For starters, it might be worth looking at the first published work by Dąbski [1]. This is another voice that shows more precisely the author's opinion in the discussion with Dobiński that has been going on for many years on the relationship of permafrost with glaciers. In the conclusion of the work, Dąbski proposes two solutions to the issue of the relationship between permafrost and glaciers:

1. Limiting permafrost to a mineral ground that, according to the Cryosphere Glossary, excludes active glaciers but includes dead ice blocks above which an active layer (non-ice) can develop; and

2. Broadening our understanding of permafrost to include all glaciers (cold, polythermal, and temperate) but also subglacial sediments that are cryotic due to saturation with cryotic glacial meltwater under pressure.

Dobiński [2] maintains his position in his reply, opting for the latter solution. His statement, however, is broader. The author strongly emphasizes the interpenetration of both environments, glacial and periglacial, both in terms of the processes occurring and the forms of sculpture (active layer, debris-covered glaciers). Thus, it can be seen that the issue of the glacier–permafrost relationship is vivid and multifaceted, still arousing lively discussion and even controversy, and therefore perhaps still far from the final solution.

The remaining works in this volume are of a more empirical than speculative nature. Their common feature is that they try to cover the glacial-permafrost issue in the geographical space from the high mountainous environment to the seacoast.

The work of Kunz and Kneisel [3] is visible here as a classic study of the glacier–permafrost relationship at a thrust moraine complex in the glacier forefield Muragl, made with the use of geophysical methods: GPR (ground penetrating radar) and ERT (electrical resistivity tomography). The detected structures provide evidence of a glaciotectonic origin of the moraine complex, which confirms the glacier–permafrost interaction during moraine formation and reinforces the theory of a polygenetic origin of the detected massive ice core in the moraine complex.

The last two works concern the Spitsbergen environment. The first, by Szafraniec and Dobiński [4], deals with an issue that is raised very rarely, namely the disclosure of the periglacial environment in the accumulative, not ablative, part of the glacial area, which is undergoing a glacial recession. The classic, originally defined periglacial environment concerned the contact area with the shore of the Scandinavian ice sheet. Szafraniec and Dobiński show that the reduction of the thickness of the Spitsbergen glaciers in a climate where MAAT <0 °C causes the discovery and rapid freezing of nunatak areas, causing permafrost aggradation, is made possible by recession of glacier ice not only at the glacier front but also to a greater extent in the accumulation area.

Kasprzak's [5] work covers the other end of Spitsbergen's periglacial environment, the coast. It relates more comprehensively to the glacier–permafrost relationship (figure 6), which is particularly visible in Spitsbergen because the distance from the seashore to the glacial area is very short and several Spitsbergen glaciers end in the sea. Kasprzak emphasizes in his work the role of salt sea water, returning to the issue of "bottom active layer" and showing the existence of a specific "permafrost wedge" as a specific form of permafrost on the coast.

The collection of these five works creates a certain harmonious whole, first showing the debatable issue and then presenting the characteristic studies showing the glacier–permafrost relationship in a relatively wide environmental spectrum. We are convinced that both the individual works and the entire collection form another positive step toward understanding this issue better. Ongoing promising methodological approaches utilizing in situ geophysical surveying and InSAR-based displacement analysis, which enable the assessment of subsurface characteristics and internal structures of the investigated landforms as well as the detection of vertical and horizontal displacements, will allow an assessment of seasonal impacts. This, in turn, will enable the current and future development of landforms that have been affected by former glacier–permafrost interactions.

References

1. Dąbski, M. Should glaciers be considered permafrost? *Geosciences* **2019**, *9*, 517. [CrossRef]
2. Dobiński, W. The occurrence of permafrost within the glacial domain. *Geosciences* **2020**, *10*, 193. [CrossRef]
3. Szafraniec, J.E.; Dobiński, W. Deglaciation rate of selected Nunataks in Spitsbergen, Svalbard—Potential for permafrost expansion above the glacial environment. *Geosciences* **2020**, *10*, 202. [CrossRef]
4. Kunz, j.; Kneisel, K. Glacier–permafrost interaction at a thrust moraine complex in the glacier forefield Muragl, Swiss Alps. *Geosciences* **2020**, *10*, 205.
5. Kasprzak, M. Seawater intrusion on the Arctic coast (Svalbard): The concept of onshore-permafrost wedge. *Geosciences* **2020**, *10*, 349. [CrossRef]