

## BOOK REVIEW SECTION

**Chu, P-Y.: *The Life of Permafrost: A History of Frozen Earth in Russian and Soviet Science*. Toronto–Buffalo–London, University of Toronto Press, 2020. 288 p.**

In the era of Anthropocene, it is important to synthesise and uncover the relationship between humans and nature throughout the past centuries. The timing could not be better to resurrect the history of the recently unstable permafrost zone at the timeliness of global climate change. Investigating the changing permafrost is considered a hot topic in light of the positive feedback loop it may cause in the climate system. In the 21<sup>st</sup> century, permafrost is recognised as a ‘time bomb’ in relation to the climate change. Due to the rapid temperature rise this mostly high-latitude area of the world is thawing. During this process, microorganisms decompose the detritus of plants and animals which had been frozen underground. As a result, carbon dioxide and methane are released, increasing the amount of greenhouse gases in the atmosphere, which intensifies warming (SCHUUR, E. *et al.* 2015). The question may arise how something

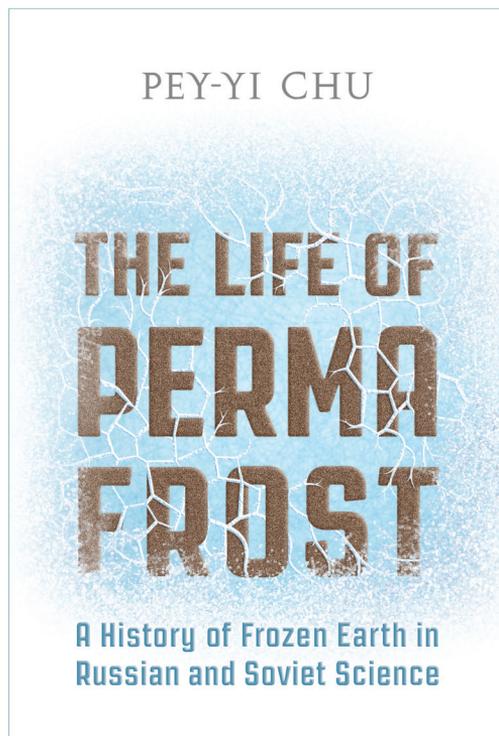
can change and be so unstable if its name implies it is permanent. Such terminological problems are rooted in the epistemological and ontological dialectic permeating the history of research on frozen earth. The complex processes during the life cycle of permafrost embrace many phenomena inseparable from each other, including nature itself and culture, society and political ideology. Therefore, science must be put in its place, by exploring the local and national context of knowledge production.

The volume addresses questions around the various conceptualisations of frozen earth throughout the 19<sup>th</sup> and 20<sup>th</sup> centuries. It recovers the multiple ontologies of permafrost, mainly in terms of whether it is a structure, a space, or a condition. Related questions include how the discourse has evolved and what kind of social and political phenomena and which scientific disciplines have contributed to shaping it. Finally, the author discusses what we can gain by recognising the multiple aspects of permafrost.

The book contains five main chapters, each divided into four subsections and a conclusion. CHU reveals the birth of frozen earth as an object of scientific research, the challenges of applied study, encapsulated debates, the adaptation of scholars to environmental and political conditions, and, lastly, the broad adoption of related terminologies. The chapters focus on how the term of frozen earth has been academised by extending it with adjectives and word collocations, which have changed over time according to the different motivations of scientists studying permafrost. The author uses a metaphor to bring this process closer to the reader, describing the life cycle of permafrost by comparing it to a butterfly.

In the introduction, the author explains her aims and puts the subject in its spatial and temporal context. Most importantly, she declares her goal is neither to cast doubt on the legitimacy of permafrost as a scientific term, nor to decide which concept of permafrost is more valid, but to historicise the notion of permafrost, the altering scientific context of which she presents in the following chapters.

The first chapter (*Mapping*) is dealing with the embryonic phase of the concept of permafrost in 19<sup>th</sup>-century Russian Empire, when the first expeditions took place to Siberia. According to that, scholars were aimed at providing a synthesised conceptualisation of frozen earth and its relationship to climate, physical geography, and the history of Earth. The frozen condition of the land became a research subject



on its own right, with a specific geographical distribution, covered by a growing network of observation stations. This approach fit Siberia into the Empire-wide and global perspective. These efforts also were in line with a Humboldtian approach to science. Yet, there was disagreement about what is actually being investigated: earth, ice, space, condition, or all aspects as a whole? The first scientific names were born in the Russian Empire, but in German language: *Boden-Eis* or 'soil ice,' referring to a substance, and *Eis-Boden* or 'ice soil,' referring to a space. In fact, a dialectic was created between the application of the concept as a component of earth system, and understanding it as an aggregate physical structure, a substance.

In chapter two (*Building*), frozen earth emerges as an object of engineering related to a physical-geographical structure, the ground. The leaders of the Russian Empire decided to improve infrastructure to encourage the development in eastern Siberia. Therefore, they undertook construction works at a very large scale, often without proper scientific knowledge and methodology. Russian engineers were the first to confront with permafrost conditions like swamps, bogs, peatlands and icings, damaging and deforming already set up infrastructures. The chapter presents that imperial engineers explicitly urged for an applied research on frozen earth, the soil science of roads. This practice continued after the Bolshevik Revolution along the 1167-kilometre Amur-Yakutia highway. During this stage, an epistemology oriented to the needs of engineering strengthened only the one side of the dialectic of permafrost.

Chapters three and four (*Defining and Adapting*) concentrate on what one may call the 'pupal' stage of the historical life of permafrost. At this phase, a scientific name and definition was formulated in the Soviet Union by the scientist Mikhail SUMGIN. Eventually, his adaptation *vechnaia merzlota* gave rise to the English word *permafrost*. However, the definition generated controversies. Chapter three focuses on the debate between SUMGIN, who regarded the phenomenon as permanent from the (anthropocentric) point of view of human life, and his rival, a gifted geographer, Sergei PARKHOMENKO, who considered *merzlota* a process formed in geologically recent times, taking thus a geocentric approach.

Chapter four reveals the process by which the definition started to spread. PARKHOMENKO's goal was to establish the correct fundamentals for understanding frozen earth, while SUMGIN concentrated on producing knowledge that contributed to the development of the Soviet economy in a relatively short time. According to the needs of civil engineering, SUMGIN's approach gained priority, which also embodied in the first full-fledged institute for frozen earth research. In those years, the centralisation of science in the USSR left no room for multiple conceptions of frozen earth. SUMGIN's interpretation of frozen earth was in line

with the major objectives of the Soviet state, which conceptually separated humans from nature, thereby implying the former being capable of conquering the latter, dramatically transforming landscapes to suite them to needs of the national economy and to get access to its treasures. In this approach, the environment was defined as both an enemy and a mystery. This chapter guides the reader to the conclusion that Soviets did not conquer the nature, just adapted to the conditions it provided, which was an economically better move than to eliminate the perennial frozen ground. The author also argues that Soviet scientists, by focusing on industrial development, contributed to the generation of waste and pollution that endangered human and non-human lives, which cannot be ignored.

Chapter five (*Translating*) puts the reader in front of the adult stage of the notion of permafrost in the post-WWII Cold War period, when the concept started to spread internationally, although the framework and the subject of this new scientific field lacked a clear definition. After SUMGIN's death, the post-Stalinist ideological revival provided space for younger scientists in the Soviet Union (especially GRIGORIEV, REDOZUBOV and SHVETSOV) to revive the alternative understandings of frozen earth. They promoted the concept of frozen earth as a space, the *cryolithozone*. They also involved the heat exchange as the key of the process, while employing some principles of Marxism-Leninism, which resulted in a concept of universal consistency rather than an ad hoc and oversimplified concept. Yet, the general circumstances did not allow the new generation's ideas to become dominant, neither in the USSR, nor abroad. By then, SUMGIN's views had already taken roots internationally, mainly in the United States, due to which permafrost became the scope of a programme by the Military Geology Unit. Although translations by Russian speaking earth scientists tried to highlight problems in terminology, the Sumginian term corresponded well to the army's practical needs, as its simplicity facilitated quick communication, similarly to the case of Russian-Soviet infrastructure development programmes.

According to my subjective evaluation, *The Life of Permafrost* is a significant contribution not only to environment history but to history of science and to geography as well. It successfully responds to social, ideological, environmental, and linguistic challenges of the topic widely known as permafrost. Human interactions with the environment mainly take the form of adaptation of the former to conditions of the latter. Poorly prepared, forced construction megaprojects and agriculture-related activities had already caused, or will cause, problems that we are not yet aware of. The book focuses on the Russian Empire and the Soviet Union, but with the rise of Soviet influence, the whole communist Eastern Europe was caught up

in the sovietisation of science and policy, including forced industrialisation, the cultivation of new crops like cotton and lemon, and related water management projects (TURNOCK, D. 1996; PAVLÍNEK, P. and PICKLES, J. 2004). The landscape changes caused by mining (LINTZ, G. *et al.* 2007), the altered hydrological and ecological conditions resulting from the installation of hydroelectric power stations (BALON, E.K. and HOLČÍK, J. 1999; TRÁSY, B. *et al.* 2018) and the provision of irrigation to meet the needs of agriculture (UJHÁZY, N. and BIRÓ, M. 2018) have led to irreversible environmental changes. The damming or diversion of rivers has extensively disturbed ecosystems as well as the interaction between surface water and groundwater (TRÁSY, B. *et al.* 2018). The installation of nuclear power plants may raise security issues due to insufficient knowledge on, and sometimes unjustified underestimation of, Quaternary tectonism, e.g. the potential reactivation of pre-existing shear zones, and seismicity (TÓTH, T. and HORVÁTH, F. 1997; BADA, G. *et al.* 2007). Thus, there is a risk that excessive environmental transformation and exploitation may backfire later.

In conclusion, I found this book very informative. The quality is greatly enhanced by the author's style, which makes the book easy to read. It is illustrated by maps and diagrams from former researchers which well support the arguments of the author. The research behind the study was built on a forceful combination of scholarly literature, archival sources and powerful storytelling that brought permafrost to life, while also employing most recent scientific findings on global climate change. Oversimplifications like 'melting permafrost' may cause false imaginaries of the climate change, which affects education and political decisions as well. In line with these, the author's comments on the current use of the term *permafrost* are entirely valid. The framework of Anthropocene evokes humans as a geological force that leaves an imprint not only on the Earth's atmosphere, but also on its soils, water bodies, and living nature (STEFFEN, W. *et al.* 2007), manifested as antropogeomorphology (GRANADOS AGUILAR, R. *et al.* 2020). That is in harmony with the author's final thoughts, that the elements of the environment may be studied, learned from, lived with, and perhaps mourned, but neither saved nor conquered. I do believe this volume will encourage further research on environmental history and history of science in other regions of the world that are under-represented in mainstream global scholarly literature.

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## REFERENCES

- BADA, G., HORVÁTH, F., DÖVÉNYI, P., SZAFIÁN, P., WINDHOFFER, G. and CLOETINGH, S. 2007. Present-day stress field and tectonic inversion in the Pannonian basin. *Global and Planetary Change* 58. (1–4): 165–180.
- BALON, E.K. and HOLČÍK, J. 1999. Gabčíkovo River Barrage System: The ecological disaster and economic calamity for the inland delta of the Middle Danube. *Environmental Biology of Fishes* 54. 1–17.
- GRANADOS AGUILAR, R., OWENS, R. and GIARDINO, J.R. 2020. The expanding role of anthropogeomorphology in critical zone studies in the Anthropocene. *Geomorphology* 366. (1): 107165.
- ILLYOVÁ, M., BERACKO, P., VRANOVSKÝ, M. and MATEČNÝ, I. 2017. Long-term changes in copepods assemblages in the area of the Danube floodplain (Slovak–Hungarian stretch). *Limnologia* 65. 22–33.
- LINTZ, G., MÜLLER, B. and SCHMUDE, K. 2007. The future of industrial cities and regions in central and eastern Europe. *Geoforum* 38. (3): 512–519.
- PAVLÍNEK, P. and PICKLES, J. 2004. Environmental pasts/environmental futures in post-socialist Europe. *Environmental Politics* 13. (1): 237–265.
- SCHUUR, E., MCGUIRE, A., SCHÄDEL, C., *et al.* 2015. Climate change and the permafrost carbon feedback. *Nature* 520. 171–179.
- STEFFEN, W., CRUTZEN, W.J. and MCNEILL, J.R. 2007. The Anthropocene: Are humans now overwhelming the great forces of Nature? *AMBIO: A Journal of the Human Environment* 36. (8): 614–621.
- TÓTH, T. and HORVÁTH, F. 1997. Neotectonic investigations by high resolution seismic profiling. In *Seismic Safety of the Paks Nuclear Power Plant*. Eds.: MAROSI, S. and MESKÓ, A., Budapest, Akadémiai Kiadó, 123–152.
- TRÁSY, B., KOVÁCS, J., HATVANI, I.G., HAVRIL, T., NÉMETH, T., SCHAREK, P. and SZABÓ, Cs. 2018. Assessment of the interaction between surface- and groundwater after the diversion of the inner delta of the River Danube (Hungary) using multivariate statistics. *Anthropocene* 22. 51–65.
- TURNOCK, D. 1996. Agriculture in Eastern Europe: Communism, the transition and the future. *Geojournal* 38. (2): 137–149.
- UJHÁZY, N. and BIRÓ, M. 2018. The 'Cursed Channel': Utopian and dystopian imaginations of landscape transformation in twentieth-century Hungary. *Journal of Historical Geography* 61. 1–16.

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