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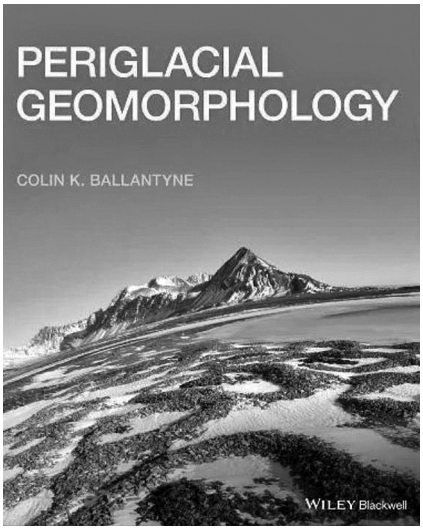
Geologos 26, 1 (2020): 91–92
DOI: 10.2478/logos-2020-0009

GEOLOGOS

Periglacial geomorphology, by Colin K. Ballantyne, 2018. Wiley-Blackwell, Chichester. 454 pages. Paperback: price $78.00, ISBN 9781405100069.



Currently, permafrost science and periglacial geomorphology witness the most notable progress within the ranks of earth science disciplines. On the one hand, this results from a more widespread exchange of information on extreme processes that affect the frozen ground and cold environments, such as rapid erosion of permafrost coastlines and/or intensified activity of periglacial processes in slope and river systems. On the other hand, the majority of predictions of climate and environmental change suggest that in most polar regions and mountainous environments, including high-altitude plateaus, there will be a reduction of both permafrost and periglacial regime that control landscape development. Another issue that promotes the recent surge in periglacial studies are investigations of the planetary surface of Mars where Earth cold-region analogues are applied to describe the mechanism of extra-terrestrial landform evolution. Finally, as a result of increased ground temperatures most of the communities living in cold regions are exposed to geohazards, including destruction of infrastructure associated with permafrost degradation. Therefore, apart from traditional scientific curiosity, the newly obtained knowledge on the development of cold region geomorphology is treated as a key to reduce socio-economic implications of a non-frozen future.

The dramatic changes observed in cold region landscapes demonstrate the urgent need of education and training of young generations of experts on permafrost and periglacial processes. There is good news for both current and future students and researchers: a unique synthesis of our fundamental knowledge on periglacial environments has been recently published by Colin Kerr Ballantyne, professor emeritus of physical geography at the University of St Andrews in Scotland.

The writing of the present textbook took almost seven years, but, to be honest, to summarise his knowledge and experience in cold region landscape evolution, gained over several decades of active research, is a genuine academic masterpiece! As his former student and active practitioner of the paraglaciation theory developed by him to conceptualise the diversity of geomorphic processes transforming previously glaciated landscapes, I feel privileged to add my humble comments on his 'life-time achievement'.

The first impression, after having read the book of seventeen chapters in six parts, is that it comes close to the great atmosphere during his lectures which always paid respect to the development of this research field by the 'fathers of periglacial science', including Łoziński, Washburn, Jahn, Pissart, Mackay, Dylik, French, Harris and Tricart (and others). They were also brimming over with field evidence and numerous examples from across cold regions and that 'stereotypical British' will to explore the natural world and challenge difficult questions deeply rooted in academic identities of graduates from leading Anglo-American universities.

Before exploring the contents of the individual chapters, I wish to draw attention to the extensive list of references which includes essential papers published during the last century, which offer further reading to those interested in the topics selected. Limited by space and the strict economy of modern publishing, the tome has somehow managed to furnish a treasure trove of illustrations,

inclusive of full-colour versions of key figures (24 all).

The first part (*Chapters 1–2*) of these '*Ten Commandments*' of periglacial research provides an insight into the history of the discipline, which is particularly heart-warming to Polish readers since it relates to the scientific achievements of Jan Dylik and Alfred Jahn, and of course, brings back Walery Łoziński, who coined the term '*periglacial*' when studying the slopes of Gorgany in the Outer Eastern Carpathians. This part also introduces the crucial elements of periglacial environments. Part II (*Chapters 3-5*) may be intellectually challenging to readers who are not familiar with university-level physics (including myself), as key physical processes controlling the functioning of cold region landscapes such as thermal regime, freeze/thaw, heat transfer in soils and rocks, significance of temperature and moisture/water variations in atmosphere, cryosphere, pedosphere and lithosphere of cold regions are discussed. The term and characteristics of permafrost physics, environmental conditions and spatial distribution are summarised, together with essential information on types of ground ice and the fundamentals of cryostratigraphy.

From a geomorphological perspective, the particularly erudite pleasure continues in parts III, IV and V, in which Professor Ballantyne describes the richness of periglacial sediments, landforms and land systems. Maybe this will be considered an exaggeration, but the parts on ice wedges, patterned ground, pingos, solifluction, cryoplanation, weathering, rock glaciers and Professor Ballantyne's beloved protalus ramparts, are pure '*periglacial poetry*'. I am more than confident that no other academic could have presented these issues in a better and more fluent way. I have also learnt a lot from the summary of aeolian and fluvial processes that shape cold region landscapes presented in *Chapters 13-14*. As a cold region coastal geomorphologist, I feel obliged to express a small dose of criticism, with reference to *Chapter 15*, which is devoted to coastal processes. During the last 10-20 years we have witnessed a true renaissance of Arctic coastal research with major progress in our understanding of the impact of permafrost degradation on extreme coastal erosion along the ice-rich permafrost coastlines of Siberia, Alaska and northwest Canada. At the same time, important progress has been made in High Arctic coastal evolution, controlled by sediment supply from rapidly deglaciating landscapes (e.g., Greenland and Svalbard) and erosional and weathering processes operating along rocky coastal systems in the Arctic and Antarctic. Somehow this is missing from this chapter; hopefully, it will be added to the next edition.

In my view, the strongest portion of Professor Ballantyne's *magnum opus* is the last, sixth part of the book. In *Chapter 16*, the fascinating world of past periglacial environments is outlined with a great compilation of environmental reconstruction techniques that can be applied to relict permafrost and periglacial sediments, features and landforms. The final chapter (*Chapter 17*) has a prophetic ring to it and paints a future scenario for permafrost and periglacial environments which more than likely will be characterised by a greater release of greenhouse gases and an intensification of extreme geomorphic processes when climate warming accelerates.

It is obvious that this textbook should be on the shelf of each and every university library and on the reading list of any student and scientist of physical geography and environmental changes. From the perspective of the Polish periglacial community, if such still exists, a thorough study of this tome will hopefully usher in a rebirth of research interests in periglaciation and frozen ground investigations that, years ago, was expressed in the establishment of the journal *Biuletyn Peryglacjalny* or in the legendary book '*Problems of periglacial zone*' by Alfred Jahn, the 50th anniversary of its publication being celebrated this year.

Mateusz C. Strzelecki
Institute of Geography and Regional Development, University of Wrocław, Poland
NAWA Bekker Fellow, Alfred Wegener Institute, Potsdam, Germany
mateusz.strzelecki@uwr.edu.pl