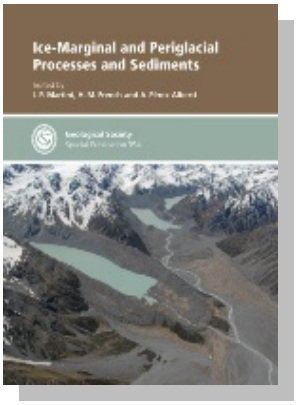

Ice-marginal and periglacial processes and sediments, edited by I.P. Martini, H.M. French & A. Perez-Alberti, 2011.
GSL Special Publications 354. The Geological Society of London (www.geolsoc.org.uk/bookshop). Hardback, 284 pages. Price GBP 100.00 (fellows GBP 50.00; corporate affiliates GBP 60.00; other societies price GBP 60.00, USD 200.00). ISBN 978-1-86239-327-1.

The ancient and recent sedimentary deposits, geomorphological problems, together with aspects that need be considered in paleo-reconstructions, of ice-marginal and periglacial environments are the subject of this book. It contains seventeen contributions, divided into two parts which are both preceded and followed by a stand-alone chapter. Basic terms are explained by the editors in the first (stand-alone) chapter, which also briefly introduces the founders of glacial and periglacial concepts.

The first part of the book deals with the ice-marginal environment and contains seven contributions. The chapter by Ingólfsson ('Fingerprints of Quaternary glaciations on Svalbard') describes the basic glacial processes and sediments of both the terrestrial and the marine environments on Svalbard, which can provide analogues for paleogeographical reconstructions. Two contributions by Lønne & Nemec ('Modes of sediment delivery to the grounding line of a fast-flowing tidewater glacier: implication for ice-margin conditions and glacier dynamics'; and 'The kinematics of ancient tidewater ice margins: criteria for recognition from grounding-line moraines') follow. Their first contribution describes the morphodynamical evolution of the Storsand moraine from the Oslo fjord on the basis of a lithofacies analysis - especially for mass-transported sediments - and the allostratigraphic method developed by Lønne (2001) for the interpretation of the ancient tidewater glaciers. Their second contribution provides some methodological guidelines, and details criteria for the recognition of short-term tidewater-glacier movement in a moraine profile. They present five allostratigraphic units, each divided (on the basis of lithofacies and processes) into four subunits which can be used for the identification of marine ice-contact sub-environments. Why the authors use here an architectural lithofacies analysis but not the well known architectural elements introduced by Miall (1985, 1988) remains enigmatic.

The ice-marginal environment in a mountainous area is dealt with in the third chapter ('The formation of Alpine lateral moraines inferred from sedimentology and radar reflection patterns: a case study from Gornergletscher, Switzerland'). Here Lukas & Sass describe the internal structure and formation of alpine lateral moraines. They compare sedimentological data with ground-penetrating-radar data from the same sites. The radar pattern provides a good insight and corresponds to the overall sediment geometries seen in the exposure. The authors conclude that, unfortunately, small-scale sedimentary structures and thin beds are insufficiently revealed by the highest resolution used (200 MHz).

Pérez, Alberti, Díaz, Martini, Pascucci & Andreucci in the next chapter ('Upper Pleistocene glacial valley-junction sediments at Pias, Trevinca Mountains, NW Spain') also deal with a mountain setting. Their study concerns sedimentation at the junction of two valley glaciers and with the regional climatic implications during the mid-Weichselian. The glacial model for the formation of the valley junction that they present is certainly worth noting.

Glaciated mountains are also the subject of the next chapter ('Palaeoshorelines of glacial Lake Kuray-Chuja, south central Siberia: form, sediments and process'). Carling, Knaapen, Borodavko, Herget, Koptev, Huggenberger & Parnachev describe one of the largest paleolakes of the Altai Mountain. They reconstruct shorelines, the paleohydrology and the paleowinds on the basis of small outcrops and by using georadar images in the field.

A main challenge for glacial researchers are the pre-Quaternary glaciations, their forms and sediments, because good research material is scarce. The chapter by Keller, Hinderer, Al-Ajmi & Rausch ('Palaeozoic glacial depositional environments of SW Saudi Arabia: process and product') describes Late Ordovician and Permo-Carboniferous glacigenic sediments in the Wajid Sandstone. In my opinion, all

Quaternary geologists who struggle with the recognition in the field of glacigenic sub-environments should consider this chapter as a must read.

The second part of the book contains nine chapters, all concerning periglacial settings. The first two chapters ('Frozen sediments and previously-frozen sediments' by French, and 'Gullies, polygons and mantles in Martian permafrost environments: cold desert landforms and sedimentary processes during recent Martian geological history' by Levy, Head & Marchant) are closely related. French lists features which can help to recognize previously frozen sediments (it is a kind of 'recipe'), like the well-known ice-wedge pseudomorphs with secondary infilling, sand veins, sand-wedge casts, frost mounds (pingos, palsas), etc., but also secondary features like clay minerals or coefficients of cryogenic contrasts. French also gives advice on how to recognize seasonal and perennial frost in sediments. The chapter by Levy, *et al.* deals with permafrost structures on the extremely cold and dry planet of Mars. According to these authors, it is essential to consider that, in contrast to the Earth, wet active layers are rare or absent on Mars. The genesis of periglacial structures is shown in this chapter by numerous photos of the Martian surface and schematic illustrations.

The next two chapters in this part of the book ('Rethinking weathering and pedogenesis in alpine periglacial regions: some Scandinavian evidence' by Thorn, Darmody & Dixon; and 'Role of lichens in granite weathering in cold and arid environments of continental Antarctica' by Guglielmin, Favero-Longo, Cannone, Piervittori & Strini) are also closely related: both concern weathering processes in a cold climate. The contribution by Thorn, *et al.* disproves the traditional theory of ubiquitous physical weathering in a mountainous subarctic environment. As an example, they describe pyrite oxidation (from marble and schists in Swedish Lapland), which produces acidic waters. This acidity is an indicator of chemical weathering. The contribution by Guglielmin *et al.* deals with biological weathering in an extremely cold environment. Particularly the role of lichens in hardening the exterior of the cupola of tafoni in Antarctica - which is far more typical of a hot environment - is detailed.

Then follow three chapters that deal with Pleistocene periglacial processes, with emphasis on slope development and slope sediments. In the first contribution ('Periglacial sediments: do they exist?'), Vandenberghe puts forward the not so daring hypothesis that 'periglacial deposits' do not correspond to any particular sedimentary process. Cold-climate environments do not produce specific clastic sediments; all can develop under other climatic conditions as well. Vandenberghe writes: "if the 'periglacial deposits' are defined as and restricted to sediments that possess distinct characteristics related to either frost or its subsequent thaw [...], it may in fact be concluded that 'periglacial sediments' do not exist with the exception of a few specific cases (e.g. icing deposits and layers composed of frost-fragmented rock debris)" but that, if post-depositional processes are included in the definition, the concept of 'periglacial deposits' could be broadened. The second chapter, by Van Steijn ('Stratified slope deposits: periglacial and other processes involved'), focuses on typical periglacial slope deposits but also on azonal sediments like debris-flow, grain-flow and rock-fall sediments. In the case of azonal sediments, the climatic interpretation of relict sediments is complicated. The third chapter, by Oliva & Gómez Ortiz, is entitled 'Holocene slope dynamics in Sierra Nevada (south Spain). Sedimentological analysis of solifluction landforms and lake deposits'. It deals with two kinds of sediments recorded in the periglacial environment: solifluction lobes and lake sediments. During warm phases slopes were more stable, and enhanced periglacial activity occurred during cold phases.

The second part of the book is concluded by two contributions ('Aeolian processes and features in cool climates' by Brookfield; and 'Cold-climate deposits and landscape modifications of the mid-Atlantic coastal plain, eastern USA' by Newell & Dejong. The first contribution compares aeolian erosional and depositional features in warm and cold deserts, both on Earth and Mars. The conclusion is best made clear by a quotation: "recognizing cool-climate aeolian sandstones requires identification of ice- and snow-related structures such as ice- (now sand-) wedges, structureless sand layers (formed by melting of snow/sand mixtures) and interbedding with other [...] facies such as tillites, outwash and glacial lake deposits [...]."

As mentioned before, the last chapter is a ‘stand-alone’ contribution. It compares the geomorphology and Late Pleistocene sedimentary features of unfrozen and previously frozen landscapes of the mid-Atlantic coastal plain.

My final conclusion is that this book forms a combination of good review articles and new research. It can be recommended to all specialists in glacial sedimentary geology and geomorphologists, but it deserves a place as well in earth-science libraries of universities.

References

Lønne, I., 2001, Dynamics of marine glacier termini read from moraine architecture: Geology v. 29, p. 199-202.

Miall, A.D., 1985, Architectural-element analysis: a new method of facies analysis applied to fluvial deposits. Earth-Science Reviews v. 22: p. 261-308.

Miall, A.D., 1988, Architectural elements and bounding surfaces in fluvial deposits: anatomy of the Kayenta formation (Lower Jurassic). Southern Colorado: Sedimentary Geology v. 55, p. 233-262.

Malgorzata Pisarska-Jamroży
Instiute of Geology
Adam Mickiewicz University
Maków Polnych 16
61-606 Poznan
Poland
e-mail: pisanka@amu.edu.pl