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REVIEW

E. R. LaChapelle. *Field guide to snow crystals*. Seattle and London, University of Washington Press, [1969]. ix, 101 p., illus. $6.50 (cloth), $2.95 (paper).

Whoever deals with snow problems and in particular with avalanche danger has to pay attention to the structure of the snow cover and its development from the moment it is deposited until it disappears in spring or is integrated as firn in a glacial cycle. Shape and size of the single snow crystals are the essential characteristics of snow structure, and their transformation—the metamorphism—is reflected in various bulk properties of snow.

On a scientific level, metamorphism of snow has been studied for several decades and the subject is treated extensively by various authors, but only selected pictures of the separate phases of metamorphism have entered the popular literature on snow and ice to illustrate the different processes. No one has ever presented an annotated complete catalogue of the various kinds of snow types as they are seen by a field observer looking at the natural stratification of the snow cover.

E. R. LaChapelle, engaged in snow research as well as in applied projects, has meritoriously filled the gap with a *Field guide* which serves, as the title says, to identify snow types in the field by using only the eyes reinforced by a lens.

After a condensed explanation of the formation of atmospheric ice the concise international classification for solid precipitation suggested by V. J. Schaefer and others in 1951 (Schaefer and others, [1952]; Canada. National Research Council, 1954) and a refined classification suggested by C. Magono and C. W. Lee (1966) are presented. A description of the two basic processes—destructive and constructive metamorphism—follows, the first being illustrated by the classical experiment carried out by H. Bader (Bader and others, 1939, p. 1–61). For classifying deposited snow the morphological scheme of the international classification of 1951 is replaced by a genetic scheme proposed by Sommerfeld and LaChapelle (1970). In applying this one has to keep in mind that a pure destructive (isothermal) metamorphism scarcely exists in nature. Destructive and constructive metamorphism compete with each other with the prevailing effect of the one or the other process according to temperature, temperature gradient and air permeability. Another remark may be inserted with respect to the term "depth hoar". This may imply the meaning that intense gradient metamorphism is necessarily a matter of the lowest snow layers. Strong gradients, however, are often encountered right at the surface (due to a negative radiation balance), and high metamorphic layers are therefore found embedded at any level of a snowpack.

A hint in this direction would perhaps have been useful for the reader interested in avalanche forecasting. But it should not be our aim to look for missing elements in a short book which, by limiting itself to the most important facts and by condensed wording, has given an admirable over-all description of the hidden changes in the snow cover.

The illustrations, applying various photographic techniques and illuminations, but always relating to the natural appearance of snow, form the essential second part of the book. Sometimes the subjects represented show only slight variation from one stage to another (e.g. figures 9, 10, 14, 15) and the spectator has to concentrate his attention to detect the specific features, but this is just the problem out in the field when poor light, wind and cold drive the snow investigator to despair.

In short, the *Field guide to snow crystals* is an excellent and probably the only available publication explaining and illustrating in an easily intelligible manner metamorphism of snow to snow rangers, alpinists, skiers and inquisitive nature-lovers.

M. R. de Quervain

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