be due to physical horizons of temperature or changes of crystal orientation in pure ice, and many observations could be due to either. One is still left with an uncertain feeling about the answer—even to wondering if our understanding of wave propagation is adequate. In any case, the evidence is produced and discussed from various angles in admirable detail.

After the geophysical chapters come the sections that carry on the theme of *Antarctic snow and ice studies* [*I*] for later traverses. Taylor presents results from the South Pole traverse of 1962–63, Koerner for the Dronning Maud Land II traverse, Rundle for the Dronning Maud Land III traverse, while Cameron and Benson report on further work at "Byrd" station during 1961–65. Benson's work includes a useful comparison with firn structure and parameters in Greenland. The benefits of the experience gained by many Antarctic glaciologists over the previous five to ten years are apparent in the quality of the observations and skill of the observers.

Major developments in the stratigraphic field, which provide basic reference data for the other studies on the high plateau, come from the work of Picciotto, Crozaz and De Breuck, whose studies covered the three Dronning Maud Land traverses. They have collected ice core samples to depths of 2 to 2.6 m for laboratory studies in Belgium. Their major work has been the determination of the level of the surge in β activity which took place in 1954–55 and forms a valuable reference horizon. They have also used the fall-off in activity of lead-210 with depth at a few stations. The methods and details of results are presented clearly. All Antarctic glaciologists are clearly indebted to these workers for applying the skills of the geochemists to the difficult problems of establishing the precipitation over central Antarctica. Their results are completely convincing and show the arid nature of this region.

A short chapter by Hamilton and O'Kelley on particulate matter in Antarctic firn presents results of considerable interest to environmentalists. They discuss the variations with time of deposition of both the insoluble and soluble impurities. The cleanest ice found from a limited number of samples was that deposited around A.D. 600 near "Byrd" station. Some results on the effect of altitude and continentality are also included. It is clearly desirable that more studies of this type should be made, as glaciologists have an outstanding opportunity to provide data of wide interest to the scientific and general community on the variations of atmospheric contamination over past centuries and millennia.

The last paper gives a useful account of the glacial geology of the Victoria Valley system by Calkin. This is a border-line topic for snow and ice studies, but it should remind the straight glaciologists of the relevance of their studies to geology and geomorphology.

The volume provides an admirable record of the application of sophisticated techniques to Antarctic glaciology during the 1960's and contains a wealth of information on many aspects of U.S. glaciological activities in the Antarctic during this period. Crary's influence is apparent not only through his effective editing of the volume, but also through his over-all guidance to the projects as Chief Scientist of the United States Antarctic Research Program for much of the decade.

G. DE Q. ROBIN

A. [S.] POST *and* E. R. LACHAPELLE. *Glacier ice*. Seattle, The Mountaineers; Seattle and London, University of Washington Press, [©1971]. [xiv], 110 p., illus. $20, £9.50.

ON the international glaciological market Austin Post's name has become well known during the last ten years and associated with the most magnificent photographs of glacier surges. So it is no surprise that a glacier picture atlas, meeting the highest possible requirements, has now been published. And it is no surprise that Post has joined forces with E. R. LaChapelle, who has contributed a great number of the ground photographs necessary for the proper

understanding of the pictures from the air. The result of this co-operation could hardly be anything but good.

It all began when Richard C. Hubley started his aerial photography of glaciers in western North America in 1955. Two years later Hubley lost his life on McCall Glacier and the photographic programme was taken over by LaChapelle. Since 1960 Post has carried the responsibility and through his efforts and enthusiasm further glaciers have been included in the annual photo-survey.

The original task was to map the extent of the present glaciers and to study their reaction to climatic changes. However, good photographs often contain a wealth of information, and it did not take long before Post became a specialist on glacier surges, having identified over 200 surging glaciers. From looped moraines and other peculiarities he could recognize this type of glacier and could even give a "surge forecast".

Glacier ice, which might as well have been called *Glaciers* since it deals with so many aspects of glaciology, contains 136 photographs and each one has something to show. It is not just a collection of beautiful pictures, they are all selected to fit the story. The text is short but well written; some of us would have liked to have just a few terms changed. It is quite obviously written for a wide audience, but, when read with the pictures, it also gives the glaciologist a lot to think about. The text is fitted to the pictures like a good accompaniment to a song. What the pictures have to say carries the message.

If you want to give a non-glaciologist friend a handsome gift, this book is a good choice—and you can use it when you try to raise money for glaciology from a donor-to-be. You can also use it to show your colleagues or students an illustration of what you are trying to describe to them; you can be almost sure it can be found in *Glacier ice*—but not necessarily mentioned in the text.

It is not much use trying to judge whether the pictures of the ogives are better than those of medial moraines or surges or crevasse patterns or surface features—they are all very instructive. My only constructive remark would be this: why not publish a separate small book with a more comprehensive text so that students of glaciology could get the full benefit out of *Glacier ice*? The present text corresponds to only twenty full pages of this journal, and for a glaciologist the excellent illustrations would be worth ten times more.

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