

## REVIEW

NORWEGIAN CIRQUE GLACIERS. W. V. LEWIS, *ed.* (R.G.S. Research Series, No. 4.)  
London, Royal Geographical Society, 1960. 104 pages, illus., maps. 25 cm. 22s. 6d.

THE research work discussed in *Norwegian cirque glaciers* was carried out between 1947 and 1952, mainly on small cirque glaciers in the Jotunheim district. The work is divided into nine sections; the introduction by the editor, W. V. Lewis, sets out the scope of the work and introduces the authors, while in the final section, "The problem of cirque erosion", Mr. Lewis sums up the results and applies them to the formation of Blea Water corrie in the Lake District.

The other seven sections cover a variety of topics and are of very different lengths and value. The most valuable section is that by J. G. McCall, on the flow characteristics of the small cirque glacier Vesl-Skautbreen, although the essential results of this very excellent study were published some years ago. The work entailed a very detailed and accurate survey of the movement of the glacier in three dimensions, on the surface and in two tunnels dug through the ice to the back wall. The account is very well illustrated with useful diagrams, in which form the data can most readily be presented. This study has provided one of the most detailed analyses of ice movement in depth yet attempted, although it is only on a small scale; this, however, creates a difficulty in that the very small rates of flow require a very high standard of accuracy in the survey. Useful observations of the character of the basal zone of the glacier are included and the section concludes with a discussion of cirque formation. This very worth-while study has carried the interpretation of corrie glacier movement beyond the stage of theory to that of fact.

The second section, by M. H. Battey, sets the scene for the more purely glaciological studies by discussing the geological character of the rocks, with particular reference to their response to glacial erosion and frost action. The discussion of the part played by joints in the rocks is useful.

Mrs. J. M. Grove has contributed two sections, on Vesl-Skautbreen banding and on Veslgjuv-breen. The former discusses in detail the characteristics of the ice bands as visible on the surface and as they outcropped in the tunnel. The study of the layers has enabled her to estimate the age of the ice in the corrie and the nature of accumulation and ablation. It provides a useful introduction to the detailed study of movement by McCall. Her second contribution concerns Veslgjuv-breen which has a more complex structure. This study shows that the movement of the two ice masses is on the whole similar. That both these contributions are based on careful and painstaking field work is clearly evident.

The section by R. J. Adie on the ice structure, using petrofabric analysis, is more technical. It includes a section on the equipment and techniques and also provides a useful statement of the character of the crystal structure in different types of ice.

A short chapter by J. E. Jackson and Ena Thomas gives some details of survey measurements made on Veslgjuv-breen in 1951 and 1952, including both horizontal and vertical triangulation.

The final chapter by W. R. B. Battle on temperature observations in bergschrunds is not confined to observations in Norway, but includes Greenland and the Jungfrauoch. This account gives some idea of the difficulties of this type of research but nevertheless valuable and interesting results are reported, providing a very worth-while contribution to the whole.

Some of the material presented has already been published, which somewhat reduces the value of the work, although it is helpful to have such detailed studies assembled under one cover. The illustrations, both photographs and diagrams, are of a very high standard, and greatly enhance the usefulness of the book. The value of combining different methods of approach to the problem of understanding ice movement and its effect on the landscape is clearly shown.

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