

THE LAKES OF MINNESOTA, THEIR ORIGIN AND CLASSIFICATION. JAMES H. ZUMBERGE. Minneapolis: The University of Minnesota Press, 1952. 99 pages, 2 plates, 48 text-figures. (Bulletin 35, University of Minnesota, Minnesota Geological Survey.)

THE author classifies the enormous number of lakes in Minnesota, describes examples, and provides explanations of the processes that created and modified them. Intended primarily for use within the State, where lakes are economically important at present as holiday resorts, the bulletin is essential to geomorphologists whose interests lie in the glacial modification of relief by erosion and deposition, to limnologists, and to those who enjoy classifying natural features.

The classification, based on readily inferred processes and on present morphology, establishes five main categories of lakes and twenty-seven types. Having read the descriptions and analyses, which are supported by clear and instructive text-figures and photographs, the reviewer considers that the resulting nomenclature is well justified and should be adopted as a standard for any similar region.

Minnesota has a long history of invasions by Pleistocene ice, ice-retreats, deposition of loess and modification of pre-glacial drainage. There is a pre-glacial relief outside the oldest drift areas, and varying degrees of river maturity have been established on the drifts themselves. On the boulder clays and eroded surfaces of the regions covered by the later substages of the last or Wisconsin glaciation there is, as yet, generally no drainage at all. Here lie the lakes described in the bulletin. Some of them are attributed to the later histories of the vast late-Wisconsin lakes Duluth (of which Lakes Superior is a remnant) and Agassiz, while some are related to local glacial history and to the effects of solid geology upon glacial processes. Here a particular discussion arises about the effects of continental ice moving along, and across, the geologically dominated pre-glacial relief. The author invokes Demorest's conception of extrusion flow. It seems that the term and inferred processes are still in need of clarification. Extrusion flow within the body of a great ice mass is regarded sceptically by some authorities.* How far it might be responsible for erosion—sometimes very deep and differential erosion—of the subjacent rock surfaces may well be regarded as still a subject for debate and further investigation.

Recent statements about profoundly thick land ice in the Antarctic and in Greenland occupying a varied rock relief suggest to the reviewer that flow at the base of the ice, where it occurs, is canalized by rock relief and caused to over-deepen the deeper parts. The author adopts the hypothesis of "obstructed extrusion flow" to explain the glacial erosion of valleys transverse to the direction of movement of the continental ice, and makes an interesting case for it, but clearly it is a problem that needs much further study.

Among many other observations the author also has some instructive remarks, supported by sketches, on the creation of ice-ramparts and pressure ridges by lake ice which he associates with the degree of rigidity and expansion of the ice on rise of temperature.

Clearly, therefore, the publication contains much of great interest to glaciologists and this review offers no more than a sample. The bulletin should have a wider scientific public than it may find in the progressive University of Minnesota and the Minnesota Geological Survey which have encouraged the studies and included them in their official publication.

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ALPINE GLACIERS. A. E. LOCKINGTON VIAL. London: Batchworth Press, 1952. 19 × 26 cm., viii + 24 pages, 86 illustrations, 7 diagrams; Index. Price 30 shillings.

THIS book makes no claim to add to our scientific knowledge of glaciers or glaciology. Neither is it addressed to the mountaineer for otherwise it would be open to criticism on account of some

* So far it has not been possible to confirm the existence of extrusion flow by empirical test.—*Ed.*

statements which might mislead him. It is a book, however, that will whet the appetite of anybody first visiting the Alps or of anybody thinking about glaciers for the first time, and as such it is welcomed.

The Publishers claim that this work is "the first of its kind" and that it contains a unique series of photographs. They seem to have overlooked earlier works, particularly *The Oberland and its Glaciers* by H. B. George (Editor of *The Alpine Journal*), with photographs by Ernest Edwards and published by Alfred W. Bennett in 1866. Many subjects photographed in the book under review are to be found in the earlier one and, in the reviewer's copy, its original photographs can still bear comparison with some of the modern ones.

The topographical details are instructive and satisfactory except that when the Author states that the Aletsch Glacier is 15 miles long he appears to have forgotten that the glacier from the Jungfrauoch to the Konkordiaplatz is the Jungfraufrirn and that the Grosser Aletschfrirn, and thus the Aletsch Glacier proper, commences at the Lötchenlücke (pages 39, 85-86, 117). The hyphenated "Jung-frau" appears several times and cannot be regarded as a misprint. It is to be hoped that it will not be copied.

The lover of poetry will be sorry to see (page 32) that the moment of exaltation which led Coleridge to write his paean of praise "... Before Sun-rise, in the Vale of Chamouni," has been attributed to Shelley.

The photographs should prove a considerable attraction but they cannot be favourably compared with recently published mountain picture books at a similar price by well-known authors. As these photographs are the product of a F.R.P.S. it must be assumed that the original negatives are good. The illustrations, however, frequently lack detail or contrast and in some cases appear out of focus.

In spite of these few inaccuracies it can be said that the book should serve as a useful introduction for the layman and the tourist to the many interesting and scenically grand features of the Alpine glacier regions. It also gives a good general idea of the structure and functions of glaciers.

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SIR, *Recession of the African Glaciers*

Recently a leading Sunday newspaper published an aerial photograph of the Kibo summit of Kilimanjaro. This photograph was taken by a B.O.A.C. aircraft within recent months. I have been fully aware of the rapid retreat and desiccation of the Kilimanjaro glaciers which were discussed in my paper published in the *Journal of Glaciology*, Vol. 1, No. 5, 1949, p. 277-81. This photograph brought home to me with a shock how rapid the process has become since the mid 1940s.

Aerial photographs of the same glaciers taken in 1943 showed erosion around the edges but the main firn surfaces were still intact. This particular photograph shows very severe ablation effects over almost the whole surface of the North Glacier in the foreground with the Credner and Drygalski Glaciers to the right showing the same degree of deterioration. Yet less than ten years ago one could have skied on those surfaces.

One can only assume that the rest of the intact glaciers of Kibo have suffered to a similar extent, which lends confirmation to my gloomy prognosis made some years ago that these rare equatorial glaciers will have almost completely disappeared within one or two centuries, provided there is a continuance of the dry climate oscillation which East Africa is at present experiencing.

Quite unwittingly this Sunday paper has provided me with the means of a rough check on the rate of regression of the Kibo glaciers since my last visit in 1945. I have on several occasions appealed for the institution of a series of annual photographic comparative checks, both aerial and at ground