

due to advance are differentiated from those formed during retreat and stagnation. The book ends with an account of the indirect effects of glaciation, including changes of sea-level resulting from eustatic and isostatic movements of sea and land, and biogeographical influences.

Both authors are familiar with present ice masses and have travelled widely in previously glaciated areas, so that they describe many of the features at first hand. They have not only relied on their own work, as the very long and detailed bibliographies show. These are arranged at the end of each chapter or section, subdivided according to the subject matter to which they refer. The book is a well documented and scholarly work, which stresses the processes operating, or which have operated in the past, to form the very distinctive glaciated landscapes. The illustrations, however, are not as satisfactory as the text; the drawings rarely reveal so clearly the features they portray as good photographs would have done, and some of the figures lack units and maps occasionally have no scale. One figure is missing and another repeated.

The geomorphological effects of ice sheets and local glaciers are differentiated from each other and from the influence of snow. These differences are important in that, although local glaciers are now generally studied more intensively, ice sheets have in the past been much more widespread in their influence on the landscape. The book can be strongly recommended to anyone who wishes to read a full account of the various theories that have been put forward to explain glacial phenomena in terms of the processes which operate in a region covered by snow and ice.

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A. HOEL and J. NORVIK. Glaciological bibliography of Norway. *Norsk Polarinstitut. Skrifter*, Nr. 126, 1962, 242 p. N. kr. 30.

A. HOEL and W. WERENSKIOLD. Glaciers and snowfields in Norway. *Norsk Polarinstitut. Skrifter*, Nr. 114, 1962, 291 p., maps, + 8 maps in separate folder. N. kr. 40.

THE description of the glaciers and snowfields of Norway by Hoel and Werenskiold is based on all available sources of information, which include early accounts as well as more modern scientific observations, although the authors' own contribution to this knowledge forms the major part of the work. The material that was used for these studies has been assembled and printed separately as "Glaciological bibliography of Norway" by Hoel and Norvik. This bibliography begins with a saga of A.D. 1202, but then there is little more until the seventeenth century, when early travellers' accounts and local descriptions, some related to boundary delineation, were becoming more common. The material is arranged chronologically, and extends to 1958, with a few addenda to 1961. It includes all references to work relating to glaciers, snow and ice in all Norwegian territories, so that Jan Mayen and Svalbard are covered as well as Norway itself. The detailed chronological list is followed by a regional arrangement of the material and an index of authors. There is a short appendix giving references to ice-dammed lakes.

In the main list, which includes articles written in several languages, Norwegian titles are also translated into English. It is very valuable for anyone planning glaciological work in any part of Norwegian territory, as it provides a comprehensive bibliography of relevant material already published. The articles are drawn from a wide range of sources and in some a short comment in the bibliography mentions the scope of the article, and some facts are given. The chronological bibliography is of interest as it shows the development of ideas and feelings towards glaciers; from being objects of awe and menace, they have become increasingly appreciated for their scenic beauty and scientific interest and as the goal of many parties of young people exploring the remote and little-known glacier regions. Towards the end of the period covered, there is increasing evidence of the more detailed scientific work, such as the studies initiated by W. V. Lewis in Jotunheimen and on Austerdalsbreen.

"Glaciers and snowfields in Norway" deals with the ice-covered parts of the Norwegian territories, although those of Norway itself are the main theme with particular reference to a few Jotunheim glaciers, of which repeated detailed surveys were made; about one-third of the book is devoted to these small glaciers. The book begins with an account of available cartographical data on glacier areas and then lists the area and number of glaciers in different Norwegian lands and regions. There is then a valuable account of glacier fluctuations in different parts of Norway and a short discussion of the relevant climatic observations. The historical evidence for the great advance of the glaciers up to about 1750 is discussed. The first part of the book ends with an assessment of the value of glaciers as sources of water-power, and, before the advent of refrigeration, of ice, which was exported for a time. Finally, routes crossing snow and ice are mentioned. The second part of the book is a very detailed account of the work of one of the authors in Jotunheimen from 1927 to 1948; during this period many observations were made on the variations of glacier length, while Hellstugubreen and Tverrabreen were frequently surveyed in detail. The geomorphological character of the glaciers and their surroundings and moraines are first described, and then a year-to-year account of work done is given. The observations included ablation measurements and flow records, using a system of stakes, while much of the mapping was done photogrammetrically. This account is then summarized. The work is then analysed in detail and flow records on the melt-stream from Hellstugubreen are also described. The third section includes the observations of Hoel on glaciers in the Okstinden region, in north Norway; this work was mainly done in the first decade of the twentieth century. Many glaciers were measured annually from cairns. These early surveys, when glaciers were advancing, are compared with one carried out between 1934 and 1944, during a phase of retreat. The area between Ofotfjorden and Tysfjorden and Frostisen and some other glaciers are also described. The book ends with useful appendixes, giving English translations of Norwegian glacier and other topographic terms.

As a whole the book collects a great deal of detailed information about many Norwegian glaciers. The field-work is perhaps described in unnecessary detail, but for those working on these glaciers or doing similar work elsewhere this is of interest. All English-speaking glaciologists must be grateful to the authors for publishing this interesting and useful work in English, thereby enabling it to become readily available to a wider circle of readers. The presentation is, on the whole, of a high standard, apart from quite a few misprints. The work is well illustrated; detailed maps of the two Jotunheim glaciers for different years are presented in a separate folder. There are many other sketch maps, photographs and diagrams, which greatly add to the value of the work. The detailed pictures of the glacier fluctuations in Norway, revealed by the observations described in the book, are of great importance to an appreciation of recent climatic change, which is so closely related to glacier variations, and has wider repercussions in other fields.

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