century culture represented an intensification, made possible by the acquisition of the horse, of a way of life many centuries old and that of the horticultural village dwellers of the river valleys of the eastern Plains, who dominated the Plains from about A.D. 800 to 1750.

This is an excellent job, remarkably complete and up-to-date, considering the pace at which archeological studies on the Plains are moving today. On the debit side, the usefulness of the book as a reference and text would have been enhanced by more illustrations, by subheads within the chapters, and by the presentation of trait inventories in lists rather than in discursive paragraphs. Otherwise there are few faults to find. The writing is smooth, and the interpretations are cautious but not overly so. The book will doubtless see extensive use in courses on North American archeology, and it is appropriate as a reference volume for college and public libraries alike.

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Northern Regions

Geology of the Arctic. vol. 1 and vol. 2. Gilbert O. Raasch, Ed. University of Toronto Press, Toronto, Canada, 1961. xv + 1196 pp. Illus. + maps. $25.

The first international symposium on arctic geology, held in Calgary, Alberta, Canada, in January 1960, was a remarkable success, and the beautifully reproduced proceedings, entirely in English, are now available. The two volumes (86 papers and 16 abstracts) and a box of 34 black-and-white maps and charts present the work of 125 contributors, many of them leaders in their fields.

Section 1, Regional Geology, comprises volume 1 and consists of papers and abstracts grouped by the following areas: the Soviet arctic (4 papers, 63 pages, no references), Spitsbergen (2 papers, 76 pages, 157 references), Greenland (20 papers, 192 pages, 214 references), Canada (15 papers, 2 abstracts, 257 pages, 346 references), Alaska (1 paper, 4 abstracts, of which one is printed twice under two titles, 11 pages, 13 references), and the Arctic Ocean basin (8 papers, 3 abstracts, 125 pages, 136 references). Probably for the first time, we now have available, in one volume, four excellent English-language summaries, with detailed correlation charts, of the tectonics and the Precambrian, Paleozoic, Mesozoic, and Cenozoic geology of the Soviet arctic.

The first paper on each geographic area outlines the tectonic history of the region and serves as an excellent introduction. The paper on the structural history of Spitsbergen is the longest in the volume. Papers on the geology of Greenland, with emphasis on northern and eastern Greenland, are admirably detailed and are marshalled mainly to cover the various geologic periods. Arctic Canada's stratigraphy is generalized by areas in four review papers, and the remaining 11 papers that are devoted to this area cover a variety of detailed topics, such as the gypsum tectonics and aeromagnetic studies. The only paper on Alaska deals with ostracods from the Gubik formation (Pleistocene). A fine series of papers on the Arctic Basin is introduced by Eardley's paper on theories of the origin of the basin.

One of the strongest reasons for holding a symposium to discuss polar geology is that many geological processes in polar areas either are unique or are modifications of those in the rest of the world. Section 2 (of volume 2) contains 21 papers and 8 abstracts which, with Craig and Fyle's paper in volume 1, are concerned with the fields of glaciology, climatology, glacial geology, permafrost, and geomorphology. There are ten review papers, most of which are excellent—for example, Legget's on permafrost, Thomas's on climatology, and Beschel's on lichenometry. Many of the ten original papers are good contributions, especially Smith's on ice-island morphology and Carey and Ahmad's on glacial marine sedimentation (however, this is based mostly on antarctic data).

Section 3, Logistics and Exploration (101 pages), contains several significant scientific contributions that seem out of place in a section having this title.

In summary, this expensive compilation contains a wealth of information and will provide a good reference work on arctic geology.

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Thallophyta

Lichen Handbook. A guide to the lichens of eastern North America. Mason E. Hale, Jr. Smithsonian Institution, Washington, D.C., 1961. x + 178 pp. Illus. + plates. $4.

Although lichens are among the most numerous small plants in many areas (covering practically every tree and rock), they are the least known and least studied plants; this is probably due to the fact that a concise, accurate, popular treatment of the subject has not been available. Thus, the handbook makes a most needed contribution. Although it is intended as a semipopular introduction to lichenology, it should prove equally useful to the professional lichenologist and the amateur.

Broad but sufficiently detailed coverage is given to morphology and reproduction. Physiology is treated in somewhat more detail, and recent advances in the chemistry of lichens are covered rather thoroughly. The various lichen acids are described, and the species in which each is found are listed. The role of chemical tests in lichen identification and microchemical analyses is clearly and concisely discussed.

The most valuable part is the section devoted to collection and identification. This section contains clear, easy-to-follow (as lichens go), dichotomous keys to 30 genera and approximately 317 species of fruticose and foliose lichens known to occur in eastern North America. Also helpful is the fact that the geographical distribution, within the area, of each species is given. Owing to the difficulty of constructing a key for the crustose lichens, the approximately 100 taxa are keyed to genera only.

There are 58 figures which include many helpful drawings of lichen structure and of several species of *Cladonia*.

The 20 plates contain high quality close-up photographs of more than 90 species. There are several macrophotographs of such hard-to-illustrate key characteristics as insidia, soredia, cyphellae, pseudocyphellae, cephalodia, squamules, reticulately cracked cortex, and many others.

It is my feeling that, as a result of the publication of this long-needed and most excellent handbook, interest in the lichens will increase significantly within the next few years.

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