augmented by textural (including microscopic textures) analyses of sediments and deposits. Most of the volume presents the resulting data for each of the three study areas separately, largely by means of diagrams, maps, and photographs. Some of these have been reduced too far and others have not reproduced well.

Other than the site-specific details, three general themes are evident in the volume: a) the present glacierization of the area; b) recent glacier fluctuations; and c) the nature of periglacial morphology in an arid environment. The first of these includes an examination of the present spatial distribution of glaciers and an explanation of it in terms of the hypsometry of the mountains, their exposure, and their latitudinal position. A variety of glaciers are found in the area, ranging from clean-ice forms (of either the Himalayan or Tibetan type) to debris-covered ones and rock glaciers of both the ice-cored and ice-cemented varieties, i.e., across the classical continuum of glacial forms in dry mountains. The evaluation of recent glacier fluctuations in the three basins is based largely on the stratigraphy revealed in natural sections and on the morphology of moraines and fluvioliglacial deposits. None of this is well controlled in the time domain and so the author's attempted correlations between the three basins are not particularly convincing. A correlative table is presented but, since it is entirely undefined on the time scale, is not of great value to the reader who might wish to compare the Buri Gandaki with other areas. Present periglacial activity, defined by patterned ground and solifluction forms, is spatially restricted by the arid nature of the environment and occurs only above 4800 m on south-facing slopes and above 4300 m on north-facing ones, and only there where snowdrifts provide moisture. Relict periglacial forms, on the other hand, are more widespread and include a variety of mass wasting deposits (such as inactive rock glaciers and thick colluvial aprons) whose development is linked qualitatively with episodes of greater glacierization.

The result is a basic geomorphic description of a high mountain, continental interior environment which will be of interest because it involves a marginal situation, glacial-marginal and arid-marginal, and because it treats the older deposits in this environment. However, it suffers the defects of an interim report of work in progress: much of the treatment is superficial in nature and many gaps remain. All of the description of the present glaciers in the Buri Gandaki is of their snouts and ablation zones, and is not complemented by work at higher elevations. The same criticism applies to the examination of sediments presented here: no attention is paid to the source areas which provided them. Finally, the failure to provide a real temporal context for the work greatly reduces its value as a contribution to glacial geology. These failures are those of a preliminary study and so are understandable. Like any reconnaissance, this one serves to direct attention to problems, rather than solve them and it is to be hoped that it will stimulate further work on glacial sedimentation processes in the Buri Gandaki, for which it is a valuable foundation.

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Lichenometry involves the use of lichens to provide estimates of relative and absolute ages of rock-bearing substrates such as moraines, outwash, or felsenmeer on which they are found. It is based on assumptions that (a) rock debris is free of lichen when deposited; (b) colonization occurs shortly after deposition; (c) subsequent lichen growth, as expressed by increase of weight, area, or most commonly, diameter or axes, occurs with a predictable pattern; and (d) within an area of similar climate, growth is a function of time passed since colonization. It is possible that the growth of a single or a combination of selected species may be calibrated by absolute ages and direct growth measurements, so as to provide a curve which allows dating of substrates up to
several thousand years old. Some slow-growing species may reach ages up to 8000 or 9000 years in parts of the Arctic (see, for example, p. 5).

Although lichens have a ubiquitous distribution, they are particularly useful as a Holocene dating tool in polar and alpine areas where material for radiocarbon or dendrochronological dating is sparse, historical records are short or fragmentary, and where species such as the "most commonly reported" *Rhizocarpon geographicum* (see p. 5 and Table 1) form a very noticeable part of the vegetative cover. Therefore, this manual, the first of any to cover lichenometry, will be an important resource for readers of this journal. It is a welcome follow-up to *Arctic and Alpine Research*, Vol. 5, No. 4, 1973, which was totally devoted to research on this subject.

The authors have assembled the chapters to consider first the pertinent lichen species and identification, followed by discussion of the basic lichenometric assumptions, techniques of measurement and sampling, and establishment and use of growth curves. The main substance of the manual is concentrated in these sections which span a wide range of concepts. However, we were surprised that examples of typical growth curves, discussion of lichen colonization, and concepts of rapid versus linear growth phases so common in regional lichenometric reports, are not included. Short chapters covering statistical treatment, applications, and problems of lichenometry are followed by an annotated bibliography.

A very important aspect of the text for those who want more than one recipe is that the authors touch base particularly well with the published literature and the multiplicity of lichenometric techniques. Nevertheless, they do help us by advocating certain of the procedures. These include aspects such as the parameter to be measured (largest inscribed diameter), the sampling method (fixed area searches are preferred), and the way to record lichen growth for direct calibration. While the experienced field workers may question some of these recommendations, i.e., is the largest inscribed diameter easier to measure than the shortest axis, they are unlikely to balk at the authors' advice to apply multiple methods where time permits. Locke et al. also wisely make the point that at all costs, one should avoid the errors of some previous workers who neglected to document their techniques.

Nine figures, including two photographs, complement the text. Some of these require more time to interpret than might otherwise have been necessary if sufficient labeling or explanation had been undertaken. A particularly frustrating example is an airphoto of the Barnes Ice Cap. This apparently shows a wealth of information according to the 11-line caption, but lacks keys on the photo itself which would have helped compensate for its rather small and too-dark reproduction. The geomorphologist may also wish the authors had labeled a simplified diagram or one of the figures to explain the basic anatomical terms of lichens which are scattered throughout the text.

The chapter on "applications" is short and helpful. It does consider some statistical studies which from the geologist's point of view may fit better into the realm and timetable of the trained botanist. Conversely, the succeeding section on "problems" appears to down-play some real frustrations and problems that arise from inability to rapidly and consistently distinguish lichens in the field, even the same species at different stages of their growth.

A small number of errors occur in our review copy of the manual. Of these the most awkward include the misspelling of the first author's name ("Lock" instead of "Locke" on the cover and page 1), the lack of page numbers opposite titles in the Table of Contents, and use of the word "smallest" where the text should read "largest" in item "1" of the "Summary" at 3F, p. 15. These are unfortunate but in no real way will minimize the great usefulness of *A Manual for Lichenometry*.

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One of the study sites of the strangely organized so-called Tundra Biome project of the International Biological Programme was a