

The monograph begins with a skeletal overview of northern prehistory and a survey of the distribution of native copper artifacts in northern North America. Native copper was clearly significant during the last 1000 years in Eskimo and Athapaskan Indian technologies over a wide area. A few native copper implements apparently also occur in Arctic Small Tool tradition contexts (some problematical), but the relationship of these scattered finds to the much later flowering of the copper technology is not directly addressed. I doubt that extension of the roots of the sophisticated late prehistoric copper technology several millennia into the past as a minor and sporadically utilized element in Arctic Small Tool tradition technology is justified on present evidence.

Two major copper source areas are known, but unfortunately they are geologically similar and unambiguous differentiation is not possible by neutron activation analysis. X-ray fluorescence analysis was primarily helpful in differentiating smelted industrial copper from native copper.

Careful analysis of the copper-working technology is the major contribution of this monograph. Available ethnographic information on this topic is fragmentary and internally contradictory, highlighting the value of careful technological study using modern metallurgical techniques. Four "morpho-technological categories" are utilized: sheets, bars, tanged forms, and blanks. The first step in the reconstructed technology was the hammering of thin (usually less than 1 mm thick) copper sheets. Artifacts such as ulus and beads might be made directly from sheets. Other artifacts were made from bars. This study demonstrates that fabrication of bars from folded and hammered sheets required application of heat either through annealing (heating of a cold-worked piece to above 300° C) or actual hot forging. Tanged forms such as points and knives were created from sheets and bars by following one of four procedural sequences reconstructed in this report. A fourth category, the blank, seems usually to be large bar-like forms which have not been shaped into finished artifacts. This typology mixes the technology of shaping with the morphology of the finished product in a sometimes confusing manner. For example, tanged forms may be cut from sheets or created in various ways from blanks and bars. Thus tanged forms do not seem to be conceptually equivalent to the other three forms.

Folding and hammering with heat treatment are the primary techniques of this technology. Secondary techniques such as cutting, abrasion and perforation vary in frequency from collection to collection, as does the frequency of sheets, bars and blanks. More work with a larger sample is needed to clarify the significance of these differences.

The authors suggest that perhaps the absence of efficient tools for cutting large pieces explains the distinctive small size of the copper artifacts produced by the sheet technique. Comparative study of the technology which produced the more massive implements of the Old Copper culture in the Great Lakes region might throw interesting light on regional variation in native North American copper metallurgy.

This study effectively documents a homogeneous copper technology in northern North America in late prehistoric times. Most will agree that this shared technology indicates significant cultural contacts among the groups involved rather than a series of independent inventions or trade exclusively in finished products. Perhaps the weakest part of the monograph is the discussion of the origins of this technology. The implications of its possible presence in ancient Arctic Small Tool tradition contexts, raised on pages 2-3, are never really considered. There is little archaeological documentation for the metal-working Alaskan "Neo-Eskimos" of the first half of the First Millennium A.D. posited on page 41. The reader may well wonder if these hypothetical metallurgists are the same as the metal-working Norton related peoples alluded to on page 3. Also, in my opinion, equation of the occasional piece of trade iron found in First Millennium A.D. Alaskan sites with the diffusion of metal-working technology from Siberia is highly premature.

The monograph concludes with a 231-item annotated bibliography which is itself a major contribution. This significant volume is not without flaws. Careful editing should have caught more of the fairly frequent typographical errors and bibliographic inconsistencies. Provenience of illustrated specimens is not given. A number of references, especially to archaeological reports, lack specific page numbers. This is always annoying when very specific points are in question. Nevertheless, all workers interested in the later prehistory of northern North America or in native American metallurgy will need to consult this important study. One hopes that it is the first of many fruitful collaborations between metallurgists and archaeologists in the north.

William B. Workman
Department of Anthropology
University of Alaska, Anchorage
3221 Providence Drive
Anchorage, Alaska 99504
U.S.A.

HIGH ALTITUDE GEOECOLOGY. Edited by PATRICK J. WEBBER. Boulder: Westview Press, 1977 for the American Association for the Advancement of Science, Washington, D.C. AAAS Selected Symposium Series No. 12. xviii + 188 p., maps, illus. Hardbound. US\$20.00.

This book is a collection of papers dealing with the ecology and occupation of mountain areas, presented at an AAAS symposium on High Altitude Geocology. Geocology can be equated with landscape ecology; because humans are an inevitable part of the modern landscape, their role is implicit in the definition. The symposium reflected the efforts of the international program concerning man and mountains, part of the Man and the Biosphere Programme (MAB) sponsored and promoted by UNESCO, and related specifically to Project 6, the impact of human activities on mountain and tundra ecosystems. The papers, all written by experts, present reviews and discussions of their fields of specialization. As with any such selection, not all facets of the theme were addressed, and treatment of them differs, some being overviews while others are more in-depth. The writing differs as well: although most are lucidly written, one is couched in bafflegab. Even though the papers date from 1977, the ideas are as cogent today as they were then. The identified problems remain the same, but their severity has increased.

Ives' paper is an apt call to action by scientists, governments, and all those who use mountain lands, to help preserve their environments. Using three contrasting areas as sample case studies to illustrate the problems confronting mountain environments, he outlines the processes which need to be understood to help solve them. His case studies — the problems of overpopulation and outmigration in the Andes and the Himalayas, the impact of tourism in the Austrian Alps, and construction of resorts in areas of natural hazards in Colorado's Rocky Mountains — lend credence to his convincing argument. I believe that the correctness of his thesis is unassailable, for without the scientific and political action for which he argues, all other contributions, however important in their own right, can very well come to nought.

Monitoring and mapping mountain environments by means of remote sensing is the theme of Knepper's paper. Despite its brevity, this selection calls attention to the complexities involved in inventorying inaccessible and remote areas. The volume's editor correctly suggests that readers who wish more information should turn elsewhere to become knowledgeable about this technique.

The broad overview of high altitude climates presented by Barry is probably as scholarly and comprehensive as can be achieved in a short paper. He summarizes what is currently known about climatic elements in these environments, identifies critical gaps in our understanding of mountain climates, and points out the value of high-level meteorological stations for monitoring air quality, for studies of wind energy and for answering more basic scientific questions. Those interested further in this topic should obtain his recent book, *Mountain Weather and Climate*.

In contrast to the other papers, Mellor's treats a single topic in depth: snow and ice in a particular environment. He considers not only the basic properties of snow and ice, but also their more obscure thermal, optical, and electrical ones. The movement and deformation of snow and ice, their compressibility, and a number of other topics are also included.

Billing's selection on the evolution, structure, operation, and maintenance of high mountain ecosystems deals expertly with the contributions of both plants and animals. During his discussion of the sensitivity of these ecosystems to environmental changes, he documents the changes caused by man and his domesticated hoofed animals. He ends with the unarguable conclusion: "Since high mountain ecosystems and their biota are particularly vulnerable to the presence of people, one must conclude . . . that there is a high degree of incompatibility between use by people and the maintenance of the integrity of these systems."

Grover's overview of high altitude physiology is sound without being overly technical, covering the major physiological consequences and mechanisms associated with movements to high elevations. Of major importance is the reduction of individuals' capacity for physical work, requiring them to do everything more slowly, something which, as Grover points out, most of us are willing to accept as a small price for the aesthetic values of mountain life.

Since the last selection, by Thomas, on human adaptation to living in mountain regions, deals with what is perhaps the most serious problem of high altitude geocology, it is unfortunate that it is so heavy with jargon. To cite but one example, "Humans living in heterogeneous and unpredictable mountainous environments serve as particularly rich examples since they provide insights into how an adaptive system based on phenotype plasticity adjusts to extreme spatial and temporal diversity." In addition, this long selection contains irrelevant information, e.g. a definition of *predictability*; much unnecessary material, e.g., "I am not aware of any study which examines the highland household possessions both in terms of their portability and how this affects [sic] their design and function but one would expect principles of cross adapta-

tion to apply here"; and a rehash of information presented in the other papers, e.g. on climatic and other physical characteristics of the environment and on man's physiological adaptation to altitude. These factors make the paper difficult to read and are likely to result in its being ignored and/or to reflect negatively upon social scientists. If interest can be sustained, however, the reader will learn that native people suffer severe cultural and physical harm as they experience the effects of competition from those at lower elevations.

Technically, the book has been inexpensively produced by photo-offset from a size-reduced typed manuscript with difficult-to-read, uneven line lengths. Use of a word-processor would have obviated this problem. There are very few typos or other annoying errors except for the use of "rather unique," about which I have a pet peeve.

Although the book focuses on alpine geocology, many of the ideas are equally relevant for arctic environments, since both are areas of environmental stress and their human occupation tends to be marginal. Hence those interested in these environments will find a number of worthwhile items. Despite the shortcomings, the material should prove worthwhile to laypersons, politicians, and academicians interested in this important part of our planet. Its contents complement existing books and articles by providing comprehensive overviews together with some new material in a readily accessible volume.

Herbert G. Kariel
Department of Geography
University of Calgary
Calgary, Alberta, Canada
T2N 1N4

RECENT TREE-LIMIT DYNAMICS OF SCOTS PINE (*Pinus sylvestris* L.) IN THE SOUTHERN SWEDISH SCANDES. By LEIF KULLMAN. Umeå, Sweden: University of Umeå Department of Ecological Botany, 1981. *Wahlenbergia*, Scripta Botanica Umensia, Vol. 8. 67 p., 37 figs., 24 tab. Sv.Kr.45.00.

Since the beginning of this century, many Scandinavian and Finnish naturalists have been interested in evaluating the influence of climate on biota. This preoccupation has not been confined to purely academic purposes, but often has arisen from a need to understand properly the historical and present state of the northern environment, in order that socioeconomic activities may fit in more harmoniously. In many northern European studies, one can find reports of this unceasing battle against Nature, in terms of dramatic events experienced by local populations. Northern lands are very susceptible to climatic change and to short-term climatic variability, and in that connection Kullman's study is most welcome.

In this booklet, Kullman has evaluated recent displacements of the Scots pine (*Pinus sylvestris* L.) tree-limit in the southern Swedish Scandes, located in west-central Sweden. The objective of his study was to measure the changing position of the pine tree-limit during the 1915-1975 period (within the now well-established short interval of worldwide climatic warming) and to correlate

it with climate. Although it would have been worthwhile to include the entire span of the warming episode, Kullman restricted his analysis to a 60-year period, probably the most important segment, because he had access to a set of data collected at the beginning of the century. Kullman revisited mountain sites where early ecologists had recorded the altitude of the uppermost birches (*Betula pubescens* Ehrh. s.l.) and had noted where the pines formed the tree-limit in 1915.

Kullman has defined the pine tree-limit as the altitude above sea level of the uppermost pine of at least 2 m in height. The exact position of the pine tree-limit is relative to the location of pines at least 85 years old. Kullman writes that if the tree-limit is occupied by a pine more than 85 years old, then no change in the position of the tree-limit occurred between 1915 and 1975. This inference is based on tree-growth data indicating that a pine takes about 25 years to reach a height of 2 m.

The main conclusions of Kullman's study are that: (1) the pine tree-limit rose by a mean value of 30 m at 53% of the sites (mainly SSE to SW sites), particularly during the periods 1936-1940 and 1946-1950; (2) the condition of the uppermost marginal forests and tree-limits has improved because of a rise in natural reproduction; and (3) continental sites were especially suited for pine seedling establishment, because maximum snow depths rarely exceed a few decimetres. Data on tree-limit and terrain conditions are numerous but treated independently; multivariate analysis would have been useful to evaluate the magnitude of impact of specific ecological factors. Information on present-day climate is rather scarce, and statistical treatment of climatic parameters of the 1915-1975 period is missing. The age structure diagrams of the uppermost pines (Figs. 4 and 5) show no connection with the temperature trend for the period June-September 1901-1975. Some improvements and discussion would have been desirable in this section. In general, the study is well documented, and one must realize that Kullman is a field ecologist giving pertinent and factual notes on the ecology of Scots pine. The booklet is well edited, and the presentation is sober, without flaws. All 32 photographs are grouped at the end of the booklet, and are useful to the reader not familiar with the Scandes region. Although some photographs are redundant, four photos of the same Scots pine taken during a nine-year interval illustrate minor changes in growth related to winter conditions. Only minor errors were noticed in the text (e.g. Fig. 5, p. 30: read TL-15 instead of TL-75; Table 19, p. 32: read years instead of år). References to northern European studies are numerous and helpful for North Americans interested in the topic. Aside from some minor problems, this study is useful, and I recommend it to field ecologists, Quaternarists, and climatologists working in northern environments, where climatic instability is quite important in the dynamics of plant and animal populations.

Serge Payette
Centre d'études nordiques
Université Laval
Cit  Universitaire
Qu bec, P.Q., Canada
G1K 7P4