In a brief incursion into politics, S.D. MacDonald observes (p. 180) that "investment in scientific research and the establishment of small field stations in the Arctic Islands is surely the least costly means of demonstrating Canadian sovereignty there," a point also made by me some years ago, as he kindly acknowledges. His recommendation is exemplified by the operations of the Polar Continental Shelf Project. Except in specialized cases, demonstration of Canadian sovereignty is not a job for the Canadian Forces, for as a warlike French Canadian Major at CF Headquarters, Yellowknife, succinctly put in to me in 1971, "Our main problem is lack of enemy!"

The papers mainly dealing with northern people make it clear, if it was not already clear to the reader, that there is no easy path ahead for the Inuit. Their uncertainty about the future is poignantly expressed by Mrs. Minnie Freeman of native birth, who in her words "permanently adopted" a scientist from the south — her husband. Her voice must be heeded when she says (p. 274) that "no one should any more be taking so lightly Inuit land claims, for that is where the fairness and equality begins for the native people." She has the evidence of archaeology on her side. Unfortunately it is at present impossible to predict or prescribe the path ahead for the Inuit; it is possible only to outline the problems, as Graham Rowley (spelt "Rowky" on p. 307) from his great experience has done. He sees the main problems as stemming from segregation between white and Inuit populations (with an estimated 58%, mainly white, of the total population dependent on government employment), competition between departments of the federal government with resulting inefficiency, lack of conservation, and poor social environment.

The final paper in the volume is remarkable only as a piece of "cultural" padding and for the phrase, "In due course, and not too long a due course at that . . .!" A pity, as the opportunity was lost to draw together the main themes of this valuable Symposium whose proceedings may long serve as a benchmark for future endeavour.

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THE LAKE ATHABASCA SAND DUNES OF NORTHERN SASKATCHEWAN AND ALBERTA, CANADA. 1. THE LAND AND VEGETATION. By HUGH M. RAUP and GEORGE W. ARGUS. Publications in Botany No. 12. Ottawa: National Museums of Canada, National Museum of Natural Science, 1982. 96 p. No price indicated.

Geomorphology has long provided a framework on which to build vegetation succession studies. H.C. Cowles set this approach in motion in 1899 with his classic study of the vegetation succession on the Indiana Dunes. The essence of his approach was the idea of a chronosequence, a *spatial* set of dunes which was ordered into a temporal landform-development sequence using the physiographic ideas of W.M. Davis. The dunes' chronosequence ran from the young, actively-moving dunes near Lake Michigan to the older, stabilized dunes further from the lake. Cowles then assumed that the vegetation growing on these dunes had developed in conjunction with the dunes themselves. The vegetation on the dune chronosequence thus represented a plant succession.

It is of some interest that in the monograph reviewed here, the authors study another large dune complex but use G.K. Gilbert as their guide to the geomorphological framework. This scheme emphasizes the diverse interplay of geomorphic forces and the resulting stochastic change in the landforms. Raup and Argus describe vegetation as being selected by the sand-movement characteristics: frequency, amount, and rate of burial and exposure. The actual species-selection on the dunes is dependent on specific life-history traits which best fit the present and recent interplay of these physical forces.

In this monograph, Raup and Argus bring together most of what is known of the origin and development of the Lake Athabasca sand dunes since post-glacial times and of the relationship of the vegetation to the dune complex. It includes not only the few published studies for the area, but also hitherto unpublished work done by Raup in the 1930s and by Argus, R. Hermesh and D. Smith in recent decades. This monograph is the first of two, of which the second (not yet published) will be a consideration of the flora and the botanical endemism in the dunes.

The first third of the present monograph is devoted to the post-glacial chronology of the regions of Lake Athabasca, Peace River and northeast of Great Slave Lake. The authors postulate that the sand for the Athabasca dunes came from exposed Precambrian sandstones which formed the beds of extensive post-glacial lakes. The evidence for the distribution and heights of these lakes (Tyrrell and McConnell) is reviewed. It is suggested that the actual formation of dunes south of Lake Athabasca started 8500 years ago, and that it resulted from: the retreat of Lake McConnell and subsequent exposure of loose sand on its bottom; the strong winds from across the surviving lake; and a depauperate vegetation which could not stabilize the sand.

The vegetation at that time is believed to have been mostly a gallery forest of *Picea glauca* var. *albertiana*, with interfluvial areas occupied by tundra. The forests did not appear on the interfluvia until after the xerothermic (hypsithermal), about 5000 BP. Intense aeolian activity appears to have occurred to the end of the xerothermic. The continuation of aeolian activity to the present time is ascribed to an environment that has not changed enough to allow more contemporary vegetation to stabilize these dunes.

This section of the monograph should be very useful for its summary and interpretation of post-glacial events. Its many figures, tables and maps are particularly welcome. However, the lack of extensive empirical evidence for the regions makes some of it speculative.

The next short section is the obligatory description, and attempt at a useful classification, of dune and related forms. The authors consider the dunes to be mostly parabolic, though transverse and oblique ridge dunes, precipitation ridges and others are reported. Aeolian residual features such as gravel pavement and dune slacks are described. The reader is assumed to have a working knowledge of dune-forming processes.

The final section is concerned with vegetation patterns on the dunes. The common vascular species which are capable of surviving the continuous physical disturbance caused by moving sand are few, numbering about ten. These species recur in almost every combination possible, so that community-type connotations are of little utility. Raup prefers the term "assemblage" as implying this more independent organization. In place of using the "succession-chronosequence" framework for discussion of vegetation-dune dynamics, Raup and Argus suggest that the vegetation is the result of a combination of environmental factors. They start by briefly discussing the factors affecting germination and establishment, with respect to gradients of moisture, sand movement, and nutrients (including organic matter). Next they describe the species which seem to survive best on dunes in other regions with comparable dune processes. This approach, used by J.T. Hack (1941) in his pioneering study of dune processes (*Geographical Review* 31:240-263), consists of dividing dunes on the basis of different rates of erosion and deposition. Raup and Argus show (though not too explicitly) that similar rates of erosion and deposition produce similar species combinations. As a plant ecologist, I found this discussion exciting, but at times frustrating because of their use of a descriptive approach in situations which cry out for quantitative measurements of aeolian and vegetation processes. Short of this, a useful table could have summarized the qualitative frequency and magnitude categories of aeolian erosian and deposition processes, and the associated species (and their life-history traits) which perform best under these conditions. Such a table would also have clarified why Cowles's successional sequences can be replaced by equally predictive systems which do not require development assumptions.

In closing, I would be remiss if I did not comment briefly on the contributions of the senior author. H.M. Raup, Emeritus Professor at the Harvard Forest, has over the last 50 years documented — in almost every conceivable habitat, from tundra to tropics — the central role of physical disturbances in determining vegetation assemblages. Raup sees vegetation as a spectrum of species having variable life histories, each adapted to the particular frequency and magnitude of the physical disturbances operating within a habitat. Readers who are not familiar with Raup's ideas may find the recent collection of his writings, *Forests in the Here and Now* (edited by B.B. Stout and published by The Montana Forest and Conservation Experiment Station, University of Montana), to be useful. The title itself indicates Raup's dissent from the developmental concepts of vegetation dynamics.

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