

development of pore spaces and permeability (how well the pores are connected), are the focal points.

Five papers in the geochemistry section describe the compositions of various oils and attempt to correlate them with stratigraphic units from which they may have been derived. Four units ranging in age from Triassic (about 250 million years ago) to early Cretaceous (about 100 million years ago) are believed to be the principal source rocks. Most of the petroleum appears to have been generated within the last 100 million years, due to burial and heating relating to Brooks Range mountain building.

The fourth section (7 papers, 8 abstracts) summarizes the extent of coal, water and other mineral deposits. An estimated volume of 2.7 trillion U.S. tons of high quality sub-bituminous and bituminous coals occur predominantly in Cretaceous age rocks in the western North Slope, representing as much as one-third of the total U.S. coal potential. Two papers on water resources illustrate the severe constraints on resource development imposed by the seasonal availability of water in this permafrost region. One paper compares the two principal tectonic settings indicated by the variety of metallic mineral deposits. Other papers describe the geology and mineralization of copper, lead, zinc, silver, tin, tungsten and molybdenum deposits.

The largest section, on stratigraphy, consists of 19 papers and 14 additional abstracts, which characterize the rock types, distribution and significance of the major stratigraphic units on the North Slope. As is typical for the entire set, papers in this section are grouped according to similarity of themes or geography within a broader organization based on ages of the strata being discussed. Thus, all of the papers dealing with lower Paleozoic strata are found together at the beginning of the section, while Tertiary and Quaternary strata are described together at the end of the section.

Geophysics (5 papers, 4 abstracts), structure and tectonics (11 papers, 17 abstracts), a synthesis section (3 papers and 4 abstracts) and 4 appendices make up volume two of the set. The geophysics contributions focus on various ways to delineate permafrost depth (of importance to petroleum development) and on paleomagnetic studies attempting to identify the presence or absence of large-scale tectonic rotations of arctic Alaska. The structure and tectonics section describes a number of studies from across the entire arctic Alaska region, documenting the displacement history, timing and temperature-pressure conditions as the Brooks Range mountains were formed by folding and thrust faulting, mainly in Jurassic and Cretaceous time. A few papers attempt to see through this younger deformation and describe the Paleozoic evolution of some areas. In the synthesis section, the 3 papers illustrate their authors' favourite arctic reconstruction scenarios. This is the weakest section of the book, because these (and many other) reconstructions rely heavily on imagination, but less so on scarce data. This problem is magnified by the addition of recent data, published since 1985, which further constrains such models. Unfortunately, there is still no model that uniquely satisfies the available data.

One of the biggest assets of this report is the emphasis on data, so that much of what appears here will never be outdated, even though some, perhaps many, of the interpretations will change in the future. In attempting to bring together as much of the available data as possible, as well as the most up-to-date interpretations of Alaskan North Slope geology, the editors have accepted the reality that researchers' interpretations sometimes differ, and there are several examples here of adjacent papers reaching conflicting conclusions. Also, the geographic coverage of the North Slope is very thorough when viewed over all disciplines, and the difficult task of organizing all of the papers into a coherent package was admirably accomplished.

There are several failures in this work. The primary drawback is that the bindings on this soft-covered set are not robust enough to withstand the expected use. Second, the technical quality is variable. Some papers have obvious editing errors, many of which

should have been identified by cursory examination. Several instances were found where parts of words, phrases or lines had apparently been omitted. Although the quality of the figures is usually excellent, a number of papers are poorly illustrated. In one case a photograph is printed upside down. In some papers, the line drawings are reproduced from colour slides and are frequently too dark to be legible. Third, I was irritated by the method used to type accented e's, which consisted of overstriking an apostrophe above a standard 'e'. An appropriate font should have been available; alternatively the accents should have been added by hand.

The target audience is clearly the geoscientific community, and principally those employed in research and development of natural resources. The book would be an appropriate item for any geoscience library, resource exploration outfit or consultant with an interest in arctic geoscience, although it would probably require re-binding after moderate use.

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REINDEER ON SOUTH GEORGIA. By N. LEADER-WILLIAMS. Studies in Polar Research, British Antarctic Survey. Cambridge: Cambridge University Press, 1988. 319 p., index, bib. Hardbound. US\$49.50.

Who would expect a monograph from a British biologist about a Holarctic species in the sub-Antarctic? Occasionally, when we contemplate a well-known commodity from an unfamiliar vantage point, we can glimpse unseen features that yield startling new insight. New facts generate new hypotheses, and the cycle of discovery, explanation and understanding is renewed. Leader-Williams's examination of reindeer/caribou biology on the sub-Antarctic island of South Georgia certainly provides us with a new look at an old species from an odd angle, but, sadly it yields none of the stuff from which revolutions are made. Perhaps my comment speaks to the solid theoretical foundation of modern population biology, for I certainly found no fault with the scholarship of the author.

Leader-Williams begins by reviewing the biology of *Rangifer tarandus*. Reindeer and caribou are members of the same genus and species. They are differentiated only at the level of subspecies. "Reindeer" is the term usually applied to the predominantly domesticated Eurasian and Scandinavian subspecies. "Caribou" is the common name usually applied to the wild North American subspecies. An unusual population of Norwegian reindeer was introduced by whalers to the remote sub-Antarctic South Georgia island on three occasions between 1911 and 1925, and the author discusses this novel natural experiment in the context of modern theories of island biogeography and population introduction ecology.

Part I sets the stage with a review of the biology of reindeer and caribou. Drawing from published North American, Scandinavian and Soviet literature, Leader-Williams develops a concise review of the state of our understanding of reindeer/caribou taxonomy and ecology. Banfield has argued convincingly (in *Mammals of Canada*, University of Toronto Press, 1974) that the genus *Rangifer* is a relatively primitive division of the deer family (Cervidae). Leader-Williams would have us believe that in spite of the fact that the oldest *Rangifer* remains have been dated at over 450 000 years, they are relatively recent cervids. No evidence is presented to refute Banfield, so I will stick with the Canadian authority on this one. Otherwise Part 1 presents a useful review of the natural history of *Rangifer*, a good overview of the literature on ungulate introductions and a brief history of South Georgia island and its introduced reindeer.

Part 2 gives a thorough comparison of the biology of the South Georgia reindeer in the context of the world literature on the genus *Rangifer*. We are informed that both sexes of reindeer have antlers,

but the males are larger and develop on a cycle quite different from females. These and a plethora of other facts reveal that indeed the biology of this sub-Antarctic population is basically the same as its northern hemisphere conspecifics. The introduced reindeer took only two years to acclimatize to the austral seasons, which are of course six months out of phase with the northern hemisphere. It seems the reindeer's biological clock is strongly synchronized to photoperiod. The reproductive biology of these sub-Antarctic reindeer is similar to that of the domesticated stock from which they are derived. Their wild cousins in North America mature slowly. Female caribou rarely give birth until they are three years old. Through millennia of domestication, reindeer seem to have been artificially selected to mature more rapidly. Typical of Scandinavian reindeer, the South Georgia males are sexually mature as calves, and females nearly always give birth to their first calves as two-year-olds.

Part 3 examines the South Georgia introduction in the context of other island introductions and theories on the ecology of introductions. In the absence of predators, on an island with no woody vegetation and no evolutionary history of herbivorous grazing, the introduced population predictably irrupted, dispersed in waves from the release site, caused habitat damage (some of it long term) and eventually reached a saturated, fairly stable relationship with available habitat. Interestingly, in the absence of most northern hemisphere mortality factors, falling off cliffs has become a significant cause of mortality for the South Georgia reindeer. Because more easily accessible forage has been overgrazed and because foraging sites on exposed cliffs are often blown free of snow, they often present fatally attractive feeding alternatives to the large-hooved animals.

The book is well illustrated with maps, tables, figures and photographs, including striking full-colour cover and frontispiece photographs showing the reindeer in their beautiful sub-Antarctic alpine landscape. Some of the figures are too convoluted and cryptic for me to easily follow. Would you know that a dark spot on a histological section labeled rSCL was a regressing secondary corpus luteum, unless you were told? Otherwise the book is handsomely produced, richly documented and cleanly edited.

On the coffee table by the armchair this book might stimulate conversation about interesting anomalies in far away places. On the library shelf it will provide a useful review document that lends further support to already well-supported theories of island biogeography and population ecology. But in the packsack of the conservation biologist responsible for hundreds of thousands of animals in millions of square kilometres of habitat alive with predators, diseases, hunters and parasites and besieged by a changing climate and the constant threat of nuclear disaster, this book won't cut much ice.

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QULIAQTUAT IŃUPIAT NUNANIŃŃIŃ: THE REPORT OF THE CHIPP-IKPIKUK RIVER AND UPPER MEADE RIVER ORAL HISTORY PROJECT. By WENDY H. ARUNDALE and WILLIAM S. SCHNEIDER. Barrow, Alaska: North Slope Borough Planning Department, 1987. 100 p., 4 tables, 14 maps and figs., 19 photos, bib. Softbound. No price indicated.

Potential readers of this report should not be put off by its unfamiliar title, as it is one of the more cogent statements of a particular people's culture that I can recall. Therein lies much of its value and timeliness. For northern residents, scholars, scientists and policy makers alike, there is increasing awareness of the value of fostering collaboration between the traditional and local knowledge of northern aboriginal peoples and mainstream science.

Documenting traditional knowledge is essential to move beyond the rhetoric, and Arundale and Schneider provide a glimpse of the knowledge that is available when time is spent with some unheralded experts — the North Slope Iñupiat.

This report is an attempt to understand the history of two river drainages that have provided important resources for these northwest Alaska residents for hundreds and perhaps thousands of years. It is based on tape-recorded interviews with 15 residents, in combination with a literature review covering a number of related subjects. The paramount role of the Iñupiat in this study is apparent.

The authors advise the reader at the outset that, in the analysis and in the writing, the oral materials are given priority. Although the written sources take supporting roles, they are nonetheless important. One of the strengths of this report is the balance, as all too often the oral history is either forced to fit a preconceived framework based on written sources, or conversely, the written sources are simply ignored.

The interview methodology is spelled out clearly, including the fact that the authors reviewed the draft report with all but two of the individuals who provided the oral information. These narrators provided further corrections, comments, clarifications and additions to what had been written. This procedure should become standard practice in all oral history work, as should Arundale and Schneider's practice of referencing oral testimony from the elders as a source, just like any other source of information. The authors provide specific instructions on how to do this, with the hope of promoting consistency and accuracy. This is not yet a canon of scholarly or scientific inquiry, and the sooner we adopt this practice the more enlightened we will become.

The report has five basic parts. These include an introduction, a presentation on the lives of the people who provided the oral history and an overview of the landscape and resources as seen by both the informants and the authors. The fourth part is an historical overview that provides the personal perspectives of the informants within a novel historical framework. Of particular interest here is the authors' recognition of the Unknown Past, a section that discusses events of a timeless or epic nature. This simple act of recognizing and categorizing this kind of information may help to further an awareness of different cultural perspectives among those who are more comfortable with the Western scientific perspective. The fifth part of the report is basically a gazetteer, which consists of an alphabetical set of descriptions listing important sites (campsites, hunting and fishing grounds, trap lines, etc.) in both study areas.

In the remainder of this review I want to highlight some of my reasons for commending this study and recommending it to everyone with an interest in northern aboriginal cultures, irrespective of their scientific bias or perspective. A constant theme that emerges throughout the course of this report is the acquisition of knowledge about the land and its resources gained through experience. Whether by walking the country as reindeer herders or listening to endless stories from knowledgeable elders, the North Slope Iñupiat continually demonstrate the intimate link between their way of life and their knowledge of the region. The sum total of their lives demonstrates the inseparability of these. Without wishing to engage in polemics, it is reasonable to suggest that aspiring northern scientists and resource managers should have the option of spending several months travelling and living with northern hunters. Or perhaps this could be part of their professional development once they are employed — self-evident, perhaps, but extremely difficult to achieve in the current climate of pressing scientific concerns and modest resources. Yet, nothing is as effective in fostering mutual respect.

The section on food resources is basically a summary of traditional knowledge on that subject. Although not classified and categorized in ways that are consistent with formal scientific training, the knowledge and insight are there in narrative form. The challenge for those who seek to build bridges between this knowledge and mainstream science is to collect and codify this information so that it is more available to those who, for want of time, money or incli-