

The author has a successful record of producing other photography books recording his world travels, and I expect that more are coming. The endorsements included in the preface by Caroline Alexander (author of several international best-sellers, including *The Endurance: Shackleton's Legendary Expedition*) and the introduction by Guy Guthridge (manager of NSF's Polar Information Program, now retired after 35 years) speak for themselves. Both speak well of the author and his dedication to putting into print what will add a new dimension to our knowledge of America's "Deep Freeze" programs. So what makes this book different from numerous others about the same time period? The value of the book is in its historical content, some of which is included in other works, but it is presented here in an attractive sequence of events. The photographs have excellent resolution and in many respects tell the story of U.S. presence in Antarctica in 1959. Historians and Antarctic veterans, both Naval and civilian, from this time period will find a great deal to reminisce about, and polar history buffs will also value this book. The map and satellite image of the McMurdo Sound area, Ross Island, and the Dry Valleys in the inside covers are beneficial for sorting out places the author mentions.

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**FROZEN IN TIME: PERMAFROST AND ENGINEERING PROBLEMS.** By SIEMON W. MULLER. Edited by HUGH M. FRENCH and FREDERICK E. NELSON. Reston, Virginia: American Society of Civil Engineers, 2008. ISBN 78-0-7844-0989-3. xxiv + 280 p., maps, b&w illus., appendices, select bib. Softbound. US\$85.00.

Although the lag time between a book's completion and its publication often seems extreme (especially to authors), there are few examples of delays as long as 50 years. However, such has been the case for Dr. Siemon William Muller's book about permafrost, the manuscript of which he set aside in the early 1960s. It is not surprising, when one couples such a long delay with the nature of the topic, that the editors (Hugh French and Frederick Nelson—both permafrost experts) chose to title it *Frozen in Time*.

To understand the *raison d'être* of *Frozen in Time*, it is necessary to examine Siemon (Si) Muller's background and qualifications. By 1940, the year he turned 40, he had spent nearly half of his life growing up in Russia, with a short span in China, where he learned English; he spent most of the last half (first as a student, then as a faculty member until his death in 1970) at Stanford University, where as a geologist he became a highly respected member of the scientific fraternity. His reputation and scientific acumen, his ability as a field geologist, and his fluency in Russian made

him an ideal candidate for tackling the problems faced by engineers in the areas of North America dominated by frozen ground.

In contrast to the relative dearth of reports on frozen ground in North America prior to WW II, a vast literature on the engineering aspects of permafrost (a term generally credited to Muller) was available in Russian. Beginning in 1942, Muller delved into the relevant Russian literature held by the Library of Congress and the U.S. Geological Survey's library so that he was able to furnish the government an engineering field guide and a technical report about permafrost by 1943. Although originally classified, the report was later published for general distribution by J.W. Edwards, Inc. It is entitled *Permafrost or Permanently Frozen Ground and Related Engineering Problems* (Muller, 1947) and is "now regarded as the first book on permafrost written in North America" (p. xx).

After Muller's service to the engineering community, he returned to his "preferred" endeavors of teaching and research (mainly paleontology and stratigraphy). Nonetheless, he maintained a sufficient interest in permafrost to track the increasing volume of information about it being produced in the United States and Canada, as well as in the Soviet Union, between 1943 and 1963. The 1963 manuscript, now published as *Frozen in Time*, is basically an update of his earlier publications. Not surprisingly, it is very similar in organization and contains many of the same illustrations, diagrams, and tables, updated where appropriate.

After a Dedication (p. v–vi) by Siemon Muller's son (Eric Muller) and brief Acknowledgments (p. vii), French and Nelson provide a well-crafted Introduction (p. ix–xxiv). In it they give a brief history of Muller's life, an analysis of his contributions to permafrost science, and details about the manuscript. A section on terminology includes a discussion about the word "permafrost" itself. They close their comments with reasons why Muller's work (after some 50 years) deserved publication. Reasons they offer include that it is "an important historical document," that it "contains information and examples that are still relevant today," that the "text was ahead of its time," and that it "provides a rare opportunity to compare the states of English- and Russian-language permafrost science" (p. xx). This reviewer agrees on all counts.

Muller's text, only slightly rearranged by French and Nelson, is divided into three substantive parts: Part 1: "Introduction," Part 2: "Permafrost Science," and Part 3: "Permafrost and Engineering Problems." In addition there are a reference section, three appendices (including a glossary), and an index.

Part 1 (p. 1–22) introduces the reader to Muller's definition of the term "permafrost," analyzes the nature of frozen ground investigations to date (i.e., early 1960s), and provides a lengthy section on terminology. The state of research on permafrost in Muller's day was such that he "faced the critical problem of having no suitable terminology in the English language to express various concepts and phenomena" (p. 13). Thus, after a critical analysis of 37 of the most

relevant terms prepared for the Institute of Permafrost in Moscow in the mid-1950s, he concluded that the terminology of the basic concepts was still in a state of flux and tried to clarify a number of discrepancies. Although Muller felt warranted to include an expanded glossary within the main text of the manuscript, French and Nelson, appropriately, have given it appendix status (p. 249–267).

Part 2, “Permafrost Science” (p. 23–79), is a state-of-the-art description of the origin, areal and vertical extent, surficial expression, and physical characteristics of permafrost. Because of the increase in research on permafrost that occurred in North America after WW II, Muller was able to add information from such scientists as A. Lachenbruch (ice-wedge polygons), A.L. Washburn (patterned ground), J.A. Pihlainen and F. Müller (pingos), R. Black and W. Barksdale (oriented lakes), and his student T. Péwé (permafrost terrain analysis). Nonetheless, his comprehensive treatment of permafrost research continued to be dominated by Russian materials. The two sections on “Ground Ice” (p. 33–47) and “Physical Properties of Frozen Ground” (p. 68–79) are quite thorough.

Part 3, “Permafrost and Engineering Problems” (p. 81–208), reflects well the objective of Muller’s involvement in permafrost research. As French and Nelson write, “There is...no doubt that frozen-ground engineering is the ultimate focus of the volume [and that] many of its parts read like a ‘how-to’ manual for engineering personnel” (p. ix). Muller treats such diverse engineering topics as logistics, drilling methods, roads and railroads, bridges, buildings, water supply, and sanitation as they are affected by conditions in the Arctic and Subarctic, and especially in those areas with permafrost. The discussion is guided by his notion that “once frozen ground phenomena are correctly understood, the design solution and construction problems become, for the most part, a matter of common sense” (p. 81).

The text is illustrated by 98 figures (his 1947 volume had 87) and 16 tables, which together occupy about 37% of the volume. The figures are generally understandable, although some of the legends are barely legible. Unfortunately a few numbering errors are present: e.g., on p. 46, Figure 18 should be 19, on p. 157, Figure 20 should be 21, and on p. 193, Figure 88 should be 93. Although there are a few typographical glitches (e.g., p. 63 and 112), the text reads smoothly enough.

During the two decades before Professor Muller set aside his manuscript, the permafrost community had evolved to such an extent that the timing seemed appropriate for closer collaboration among permafrost scientists and engineers. As a result, in 1963 the First International Conference on Permafrost was held in Purdue, Illinois. Si Muller attended that conference and speculation abounds about whether there is a connection between that event and his decision to set aside his manuscript.

The American Society of Civil Engineers (ASCE) deserves congratulations for bringing Muller’s manuscript out of hibernation after nearly half a century and agreeing to publish it—a great service to the permafrost community.

I recommend the book to all individuals who may be interested in cold environment landscapes and suggest that it be assigned reading for all students dealing with periglacial environments and cryospheric topics.

#### REFERENCE

Muller, S.W. 1947. Permafrost or permanently frozen ground and related engineering problems. Ann Arbor, Michigan: W. Edwards, Inc. 231 p.

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AFTER THE ICE: LIFE, DEATH AND GEOPOLITICS IN THE NEW ARCTIC. By ALUN ANDERSON. New York: Smithsonian Books/HarperCollins Books, 2009. ISBN 978-0-06-157907-3. vi + 298 p., maps, notes, index. Hardbound. Cdn\$34.99, US\$26.99.

This book is not an easy read. Not that the writing is jargon-ridden, convoluted or dull—far from it. As befits a professional science writer (Anderson has held senior editorial positions with *New Scientist* and *Nature*), the author delivers crisp, fluid prose that keeps the reader engaged and turning pages. He summarizes with admirable precision the findings of a remarkable range of scientists and the views of northern politicians and activists but lets them convey their ideas in short but incisive quotations, rendered in plain, non-scientific language.

Rather, the difficulty with this fascinating read lies in comprehending and accepting its primal message: the entire Arctic—ecosystem, economy, and human population—is changing in fundamental ways; the changes are more far-reaching and rapid than previously thought; and they are well-nigh irreversible. Hence the title: *After the Ice*.

The opening is not auspicious: the author describes his first polar bear viewing on an initial trip north and his anger when informed that the bear was starving and probably wouldn’t “make it” because shrinking sea ice had reduced its hunting prospects. Happily, the threat of adding to the plague of “gee-whiz” accounts of the Arctic by wide-eyed newcomers immediately gives way to an impeccably researched and remarkably thorough account of the changes transforming the Arctic.

*After the Ice* is based on wide travels throughout the Arctic—to Svalbard, Ilulissat, Anchorage, and Grise Fiord, among other places—and to academic conferences and research centres across the globe. It is driven by a quest for understanding the complex environmental and political processes of the modern Arctic and a hope of discerning ways to ameliorate or at least accommodate the massive