

## **Frozen In Time: Permafrost and Engineering Problems**

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## Book Reviews

FROZEN IN TIME: PERMAFROST AND ENGINEERING PROBLEMS. By Simon Wm. Muller, edited by Hugh M. French, and Frederick E. Nelson. Reston, Virginia: American Society of Civil Engineers, 2008. 280 pp. \$85.00 (softcover). ISBN 978-0-7844-0989-3. Part of ASCE's monographic series of the Technical Council on Cold Regions Engineering. ASCE Book Orders: P.O. Box 79404, Baltimore, MD 21279-0404, U.S.A.

This book is a comprehensive and landmark dissertation on the knowledge of permafrost science and engineering as known during the 1940s and 1950s from both the Soviet Union and North America. During this period Simon Muller undertook his classic permafrost field investigations, reviewed the Soviet literature and prepared several published and unpublished manuscripts. Following a dedication by Muller's son and a lengthy explanatory introduction by the co-editors, the book itself is divided into three parts: an introduction, a discussion of permafrost science and permafrost, and engineering problems and practices. All 144 original figures are presented. Three appendices consist of a select bibliography, a glossary of permafrost terms, and a related key to the glossary sources.

Muller is considered the "father of permafrost" in North America. The introduction by the co-editors explains the circumstances under which Muller is credited with coining the term permafrost. Suffice to say Muller, a professor of paleontology at Stanford University, was commissioned by the U.S. Geological Survey and the military to undertake the investigation of permafrost terrains during World War II as development of roads and airfields to Alaska and the Asian Far East became critical to the war effort. At the time, knowledge of permafrost in North America was extremely limited. In 1947, and based on his earlier reports, Muller authored the first commercially available, English-language book on permafrost; *Permafrost or Permanently Frozen Ground and Related Engineering Problems*. This 231-page monograph was based on his several years of field observations and his extensive review of the vast Russian-language literature. Muller, borne in Russia and having received his early education there, was linguistically equipped to review this extensive literature. The published manuscript was updated throughout the 1950s and into the early 1960s and incorporated the emerging English-language literature. For unknown reasons, he ceased work on the evolving manuscript. Upon his death in 1970, his former Stanford graduate student, Troy L. Péwé, acquired many of Muller's files, including the unfinished manuscript. At some point earlier the manuscript was reviewed by Canadian permafrost experts R. J. E. Brown and G. H. Johnston and the review and document were subsequently recovered by Hugh M. French. This gap of more than 40 years from the time Muller ceased work on the manuscript (latest bibliographic citation is 1963) until it was edited and published gives rise to the phrase "frozen in time." The book was formally unveiled in summer 2008 at the Ninth International Conference on Permafrost in Fairbanks, Alaska. Muller attended the First international Conference on Permafrost at Purdue University in 1963, essentially as an observer. Ironically, at the time of Muller's death in 1970 the controversial design of the Trans-Alaskan Pipeline System crossing extensive areas of permafrost terrain was in progress. Many of the problems identified in the

1940s and 1950s by Muller presented similar challenges to the design and construction of the pipeline and ancillary facilities.

The introductory part one contains an extensive discussion of definitions of permafrost, and related Soviet terminology, and provides insights into the bureaucratic review processes that prevailed among Soviet institutions. Some 36 terms that were under review are discussed in detail by Muller.

Part two on permafrost science presents discussions on the origin and distribution of permafrost, ground ice, and related hydrologic processes such as pingo formation, and distinctive landscape features including patterned ground, thaw lakes, and other thermokarst and erosional features. The importance of vegetation on permafrost conditions is introduced from the Soviet literature. A section on physico-mechanical properties of frozen ground and related soil moisture migration concludes this section of the book.

Part three on permafrost engineering problems constitutes about half of the book and is introduced by a section on the importance of logistics in planning and is followed by discussions on methods and instruments including those used to measure temperature and frost heave, and to conduct excavations and drilling in frozen ground. Problems related to and solutions for the design and construction of roads and railroads are largely based and illustrated on Muller's own field experiences. Sections on airfields, bridges, dams, mining, foundations, water supply, and utilities are all treated in detail.

Appendix I is an extensive bibliography found in the original manuscript. Interestingly, among the last reported 1960s references are several by this reviewer or his soils colleagues (see book for Brown et al., 1962; Tedrow, 1962; Tedrow and Brown, 1962; and Ugolini et al., 1963). Appendices II and III contain a valuable glossary of permafrost terms and their sources.

The book represents an important historical documentation on the development of permafrost science and engineering. The book belongs on the shelves of libraries, students, and practitioners interested in learning about these early developments. The basic and practical knowledge reported from the mid-20th century is still valuable to all those involved in working and living with permafrost. The American Society of Civil Engineers and the monograph's champion for publication, Rupert "Bucky" Tart, also a practicing engineer, and the co-editors French and Nelson, are to be congratulated for thawing the manuscript and producing this exceptional book.

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