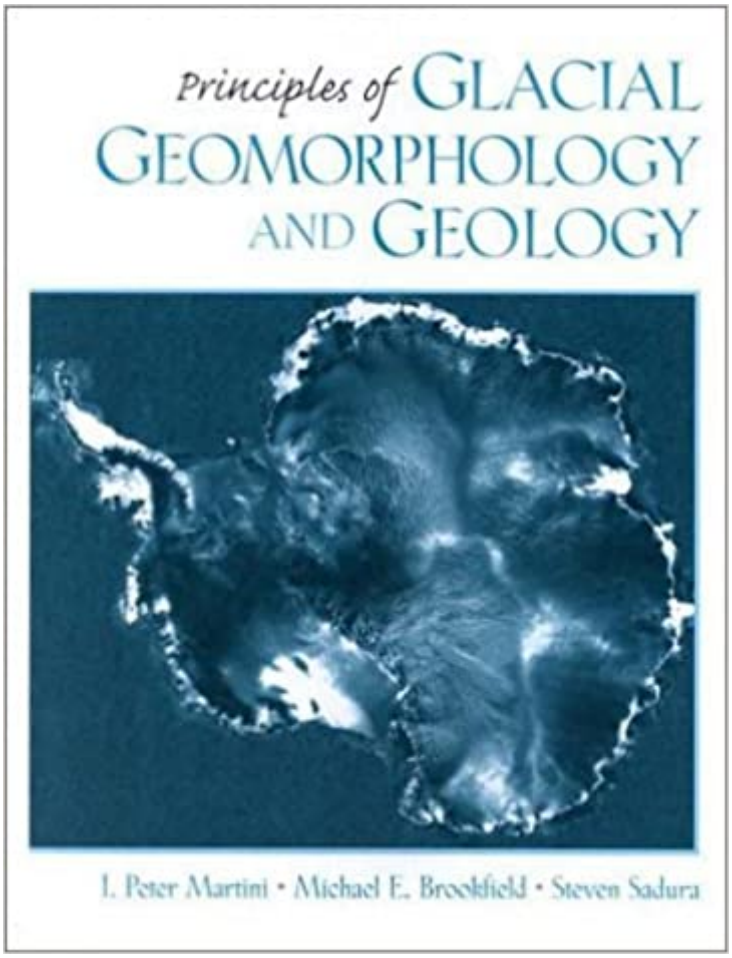
Principles Of Glacial Geomorphology And Geology



Synopsis

Featuring an accessible, non-mathematical, but rigorous conceptual treatment--with numerous very simple explanatory illustrations--this introduction to the basic principles of glaciology, geomorphology, and geology serves as a portal to the more advanced literature in the field and to discussion and research of the local situation. Focusing on processes and history (not just descriptions), it helps readers understand how glaciers form and move, what effect they have, when and where they have affected the Earth, and the consequences of ice ages. Covers a full range of topics from glaciology, geomorphology, and glacial geology: Ice Properties. Glaciers. Glacial Erosion. Glacial Transportation And Deposition. Glacial Landforms Formed By Glacial Sediments. Fluvial Sediments And Landforms. Glaciomarine And Glaciolacustrine Environments And Deposits. Aeolian Sediments And Landforms. Cold-Climate And Frozen-Ground Processes And Features. Quaternary Stratigraphy. Glacial Legacy (Isostasy, Eustasy, Volcanism, And Biota). The Cenozoic Ice Age. Pre-Quaternary Glaciations. Causes Of Glaciation. For anyone interested in Glacial Geology and Geomorphology.

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Preface We live in an interglacial period during which glacier ice covers 11 % of the continents. A further 11 % of the ground is permanently frozen, 12 % of the surface water is frozen, and ice surrounds us in the atmosphere. This sphere of ice (cryosphere) influences all our activities. Changes in average global temperatures of just a few degrees Celsius or changes in insolation at mid-latitudes can either move us into a warmer interglacial time or, conversely, plunge us back into a full glacial period. In either case humankind will have to make tremendous efforts to adjust to changing climatic conditions: including dryer conditions in some places, wetter conditions in others, and changes in sea level. All this is nothing new; it has gone on for the last 2.5 million years of recent geological time, and has occurred several times before during the last 3 billion years of Earth's history. The so-called ice ages occur when the average temperature on Earth is so low (approximately what we have today) that small temperature changes (a few degrees Celsius) may force alternating periods of glacial advance (glacial periods) and retreat (interglacial periods). We are now living in the most recent interglacial period, called the Holocene: a time of rapid change in the last 10,000 years. Changes bring difficulties, but also opportunities if we are prepared for them. This book aims to help the reader understand the processes and history of glaciation: how glaciers form and move, what effect they have, when and where they have affected the Earth, and the consequences of ice ages. The approach is to analyze the workings of present glaciers and learn how to "read" the sediments and landforms left by previous glaciers. To do this we first need to understand how glaciers form and act: this is the field of glaciology. Then we need to analyze how glaciers and the meltwater derived from them interact with the substrate: how they erode it, how and where they deposit sediments, and what landscape they develop; this is the field of glacial geomorphology. Finally, we need to establish what kind of sediment and rock past glaciers have left behind, and the history of glaciation they record; this is the field of geology. These three approaches constitute what we call here the "Principles of Glacial Geomorphology and Geology." We use the

term "principles" because the fundamental processes and their effects are the major focus of the book, rather than detailed analysis of any particular region or environment. This book is designed for science and nonscience students alike who have an interest in natural sciences and in understanding how nature and humanity have been tremendously impacted by glacial events. It is designed for anyone who has completed a first-year university geology or geomorphology course, and/or some high school science courses. For this reason, the subject matter is approached in a scientific manner, but using a minimum amount of mathematics. For those wanting to pursue a topic further, numerous up-to-date references are reported in the two volumes by Menzies (1995, 1996), the book by Berm and Evans (1998), and for periglacial settings, that of French (1996). Geology and geomorphology are visual subjects. So we have included numerous photographs and diagrams, many of which are "classics" in this field. To keep the cost of the book down, black-and-white photographs have been used. However, stunning color pictures are available in books like that by Andersen and Borns (1994) and on numerous World Wide Web (WWW) sites on the Internet. The site http://instaarcolorado.edu/ provides good information and gateways to many other sites dealing with glacial geomorphology and geology. A WWW site companion to this textbook will update information with the help of the readers. Any feedback, constructive criticism, suggestions, information, diagrams, or stunning photographs you have to offer will be welcome and duly acknowledged. Please contact us via our website at www.prenhall.com /glacial. I.P. Martini M.E. Brookfield S. Sadura University of Guelph, Ontario, Canada

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