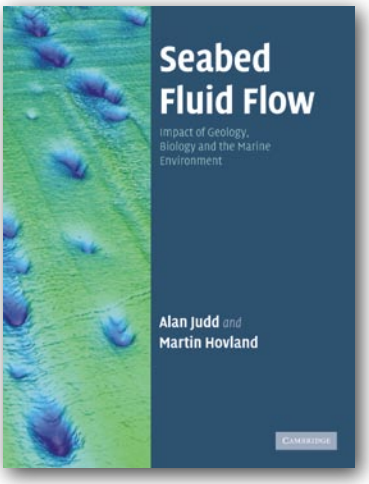
Seabed Fluid Flow

The Impact on Geology, Biology and the Marine Environment



By Allen Judd and Martin Hovland, Cambridge University Press, 2007, 475 pages, ISBN 9780521819503, Hardcover, $160US, also available in eBook format

REVIEWED BY GUNTER WEGENER AND ANTJE BOETIUS

When their previous book *Seabed Pockmarks and Seepages* was published in 1988, Martin Hovland and Alan Judd were the first authors to illustrate and discuss global geological, geophysical, chemical, and biological patterns in seafloor structures related to fluid flow, especially those caused by eruption of gas. For many years, this book was the only comprehensive reference in the field of seepage structures. Only slowly would journal publications become available that connected fluid flow, seabed deformation, carbonate crust precipitation, gas emission, and methane-fueled benthic communities—just as proposed in a highly visionary manner by Hovland and Judd in 1988, based on seafloor surveys by the oil industry and governmental institutions.

Today, after the discovery of vast methane reservoirs in the seafloor and their relevance not only for exploitation by the energy industry but also as a major factor in continental-slope stability, as a potential greenhouse gas affecting Earth's climate, and as a source of energy for a still unknown diversity of marine life, an ever-increasing number of scientists from all marine disciplines study seabed fluid flow. Thanks to major innovations in marine technologies that allow high-resolution acoustic and visual surveys of the ocean floor, as well as targeted sampling, we now know that fluid flow contributes significantly to the structure and variation of the seabed worldwide—but many of the underlying processes and consequences are still enigmatic. Alan Judd and Martin Hovlands have been at the forefront of research on seepage for decades, and have worked hard to provide an update to their classic book. (We can testify that they worked on it even at sea!)

Now, almost 20 years after the publication of its predecessor, the newly published *Seabed Fluid Flow* contains an important update of the scientific knowledge regarding many different types of seabed structures, and it represents an essential compilation for scientists and scholars studying submarine seepage. Although the book is advertised as targeting scientists and professionals, it remains the only comprehensive source available to marine science students seeking an overview of definitions, tools, and theories relevant to seabed fluid-flow research. It should be noted that the book is accompanied by a diverse set of online materials that instructors and researchers will find useful, including maps, color versions of many of the illustrations, and presentations by colleagues of the authors (see http://www.cambridge.org/9780521819503).

As to the contents of the book, the first chapters (1–3) give an overview of the main fluid-flow-related seabed structures known around the world, including pockmarks, mud diapirs and mud volcanoes, gas and oil vents, and seafloor hydrate reservoirs. The authors do not limit themselves to describing the most famous systems—the North Sea pockmarks, Haakon Mosby Mud Volcano, Mediterranean Ridge, Blake Ridge, and Cascadia margin—but also provide preliminary information on a variety of less-well-known, novel systems that are currently being explored.

Following this global overview of the diversity of seabed fluid-flow structures and their main characteristics, chapters 4–7 discuss the context of fluid flow, offering brief, encyclopedia-like explanations of geologic, oceanographic, and biogeochemical settings of fluid-flow structures. These chapters provide the backbone knowledge of related disciplines that is needed to understand the main processes leading to fluid flow and seabed alteration. The authors discuss hypotheses on the origin of fluid flow, fluid composition, and seabed structures, and invite the reader to pursue additional sources where needed. We particu-

larly like the many helpful definitions of technical terms in seabed fluid-flow research; however, we found a few errors in the description of biogeochemical and microbiological processes in this section.

Chapters 8–11 highlight the consequences of fluid flow on the biology and mineralogy of the seabed, as well as the implications of oil exploration for climate change on Earth. The discussion of methane emissions to the atmosphere from the seafloor is especially important, and there is a summary of various methods for obtaining estimates of these emissions. The final word on fluid-flow structures as special habitats for marine life and their unique and not yet fully explored diversity is very thoughtful and represents ongoing discussions on biodiversity and its protection.

Each chapter starts with a main take-home message, and also provides some simple schemes or classical illustrations to visualize the principles discussed in the text. Certainly, color figures would have been more attractive, but may have made the book unaffordable to many readers. The well-written text is lively, especially where the authors discuss their main areas of expertise, drawing on an impressive reservoir of interdisciplinary observations gained during their more than 30 years of fluid-flow studies. The scientific reader can profit from a thorough and well-updated collection of literature references, but most of all from the presentation of various fields' controversial ideas about fluid-flow seabed structures: the abiotic origin of petroleum, the effect of tides on seepage, the relationship between fluid flow and cold water coral habitats, and many more.

If you ask yourself "Do I need the update if I have the 1988 version of the book?" the answer is yes. While the excellent introduction to pockmarks of the North Sea is retained from the previous book, *Seabed Fluid Flow* gives more room to other seep structures and their global distribution, such as mud volcanoes and hydrate systems. The chapters on the context of fluid flow, and the morphological diversity of seabed structures related to fluid flow, are much more detailed. New and certainly valuable—especially for nongeologists—is the chapter on migration and seafloor features that provides an insight into basic geotechnological factors influencing fluid flow. In conclusion, this book provides an excellent overview of submarine seepage phenomena, and stimulates ongoing scientific discussions needed to understand these systems. We recommend *Seabed Fluid Flow* to scientists and other professionals, but certainly also to students specializing in fluid-flow-related topics.

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