



Rock Fractures in Geological Processes

By Agust Gudmundsson

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Rock fractures control many of Earth's dynamic processes, including plate-boundary development, tectonic earthquakes, volcanic eruptions, and fluid transport in the crust. An understanding of rock fractures is also essential for effective exploitation of natural resources such as ground water, geothermal water, and petroleum. This book combines results from fracture mechanics, materials science, rock mechanics, structural geology, hydrogeology, and fluid mechanics to explore and explain fracture processes and fluid transport in the crust. Basic concepts are developed from first principles and illustrated with worked examples linking models of geological processes to real field observations and measurements. Many additional examples and exercises are provided online, allowing readers to practise formulating and quantitative testing of models. Rock Fractures in Geological Processes is designed for courses at the advanced undergraduate and graduate level but also forms a vital resource for researchers and industry professionals concerned with fractures and fluid transport in the Earth's crust.

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Editorial Review

Review

"This is an exceptionally comprehensive and timely book. Fractures and fracturing provide the key controls on virtually all of the important geological processes in the lithosphere and yet are commonly marginalized in traditional structural geology texts. This book redresses that imbalance and is therefore an extremely welcome and overdue addition to the literature. It covers rock fractures at all scales, and every aspect of rock fracturing from basic theory to field applications. It features detailed analysis of real field data and many helpful worked examples. It will prove invaluable to advanced undergraduates and graduate students as well as to geological researchers. It should be on everyone's bookshelf."

Philip Meredith, University College London

"Agust Gudmundsson brings to Rock Fractures in Geological Processes decades of astute field observations from Iceland and around the world. He combines this rich observational background with careful quantitative analysis based on a thorough knowledge of rock mechanics. This volume is an excellent textbook for advanced undergraduate and graduate students, as well as a "must have" reference volume for anyone interested in the fracturing and faulting of rocks on land or beneath the sea."

Ken C. Macdonald, University of California at Santa Barbara

"This systematic account of fracturing and brittle deformation in geological processes is very well written and develops the theoretical concepts from first principles. The author is well known for his innovative combination of theoretical analysis and field observations, and he provides an excellent summary of fracture development phenomena and deformation in brittle environments. With clear illustrations and many good field images that support explanation of the key concepts, this book will be of particular interest students and researchers of volcanic processes and deformation in volcanic rift systems."

Stephen Sparks, University of Bristol

"... geoscientists who enjoy the quantitative treatment of structural geology, and geomechanics will find this book useful. Students and academicians who possess an advanced knowledge of engineering mathematics will find the quantitative treatments and exercises to be readily understandable ... Gudmundsson deserves great credit for this fine book. His methodical approach to covering so much detail, while at the same time separating out the more rigorous details, makes it an impressive addition to the library of any geoscientist working in geomechanics ... keeps you engaged due to its liberal use of graphical and photographic visual aids and worked exercises at the end of each chapter."

David J. Scarpato, Environmental and Engineering Geoscience

About the Author

Agust Gudmundsson holds a University of London Chair of Structural Geology at Royal Holloway. He has a PhD in Tectonophysics from the University of London and has previously held positions as research scientist at the University of Iceland, Professor at the University of Bergen, Norway, and Professor and Chair at the University of Göttingen, Germany. Professor Gudmundsson's research interests include volcanotectonics, seismotectonics, and fluid transport in rock fractures and reservoirs. He has published more than 130 research papers on these and related topics, is on the editorial boards of *Terra Nova*, *Tectonophysics*, the *Journal of Geological Research*, and the *Journal of Volcanology and Geothermal Research*, and is a fellow of the Iceland Academy of Sciences and Academia Europaea. The book draws on Professor Gudmundsson's extensive experience in field, analytical, and numerical studies of crustal fractures and of teaching undergraduate and graduate courses in structural geology, geodynamics, hydrogeology, rock mechanics,

reservoir geoscience, seismotectonics, and volcanotectonics.

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