Clays in the Critical Zone

Clays and clay minerals are the most abundant natural reactive solids on the Earth's surface. This comprehensive review considers clay science in the context of the Critical Zone – the Earth's permeable near-surface layer. Providing information on clays and clay minerals related to geological, biological, and material sciences in the Critical Zone, it is well suited for graduate students and researchers interested in clay science and in environmental and soil mineralogy. The book starts with an introduction to clays and clay minerals, their historic background, and a review of how clay science impacts the Critical Zone. Examples and applications demonstrate how clays regulate habitats and determine the availability of other resources. These examples are supported by quantitative field data, including numerical and graphical depictions of clay and clay mineral occurrences. The book concludes by covering Critical Zone clay geochemistry and clay sequences, with implications for the industrial, synthetic medical, and extraterrestrial world of clay science.

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CAMBRIDGE
UNIVERSITY PRESS

Shaftesbury Road, Cambridge CB2 8EA, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

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www.cambridge.org
Information on this title: www.cambridge.org/9781107136670

DOI: 10.1017/9781316480083

First published 2018

A catalogue record for this publication is available from the British Library

ISBN 978-1-107-13667-0 Hardback

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Preface

This book is primarily an outgrowth of class notes developed from a career of teaching courses in clay mineralogy, surface processes, mineralogy, and an interdisciplinary (geology, ecology, and anthropology) summer field program. The information and data presented come from many sources; however, I take full responsibility for errors and omissions presented herein. The premise for this book is an appeal to demystify the theories behind the many analytical approaches used in the study of fine-grained materials. I use analogies that might seem trite, but given the goal of presenting clay science to those from many disciplines, if just one connection is made to one person, then success has been achieved. Critical zone (CZ) science and clay science are not new, but the design of this book is meant to emphasize the importance of clay minerals in the context of this complex "thing" we call the CZ. The Earth is not static, and our ability to advance science is dynamic. Therefore, I look forward to seeing an updating of the concepts presented in this book, with a target of improving our understanding of clays in Earth history, as well as seeing clays predict the impact of human activity on the evolution of the CZ.

Acknowledgments

First and foremost, deep thanks are given to my family (John H., Dot, John E., Rick, Carol, Joanne, Hilary, Dusty, and Heidi) and friends (Glenn, Rick, Gregg, and Rico), who have always nurtured curiosity and afforded me the luxury of time to pursue a career as a geologist. My wife, Linda, has been the most generous and supportive of all. Academic mentors whose shoulders I stand upon include Charlie Doolittle, Taylor Loop, Larry Doyle, Bob Berner, Bob Reynolds, and Harry Dahl. Also included are the multitudes of fantastic professors, classmates, students, and collaborators I have crossed paths with while attending or working at New England College, the University of South Florida, Texaco, Yale University, the Clay Minerals Society, and the University of Georgia. Juergen Wiegel, Gennady Karpov, Bob Pruett, Renee Prost, Glenn Stracher, Doug Crowe, Mike Roden, and Dan Richter have been wonderful collaborators. Mike Velbel and Bruno Lanson gave excellent comments. Finally, *çok teşekkür ederim* to all my Turkish colleagues, for whom added words cannot express my gratefulness for your generosity. In particular, Ömer Işık ECE is an unstoppable force who has expanded my horizons.