Geology DIIMIES

Learn to:

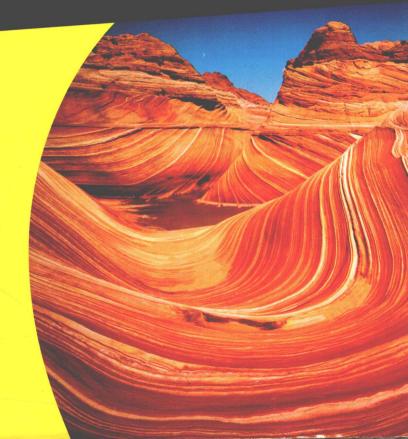
 Grasp the study of the earth, its materials, and its processes

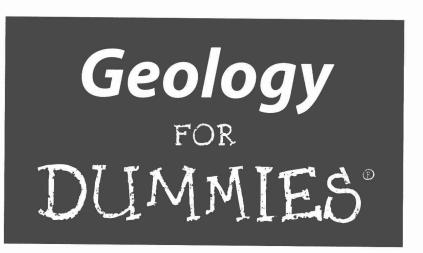
Recognize rocks, minerals, and geologic marvels

Score your highest in geology courses

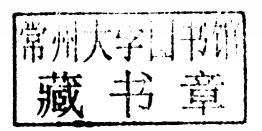
Alecia M. Spooner

Associate Professor of Earth Science, Everett Community College





by Alecia M. Spooner



John Wiley & Sons, Inc.

Geology For Dummies® Published by John Wiley & Sons, Inc. 111 River St. Hoboken, NJ 07030-5774 www.wiley.com

Copyright © 2011 by John Wiley & Sons, Inc., Hoboken, New Jersey

Published simultaneously in Canada

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at http://www.wiley.com/go/permissions.

Trademarks: Wiley, the Wiley Publishing logo, For Dummies, the Dummies Man logo, A Reference for the Rest of Us!, The Dummies Way, Dummies Daily, The Fun and Easy Way, Dummies.com, Making Everything Easier, and related trade dress are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc., is not associated with any product or vendor mentioned in this book.

LIMIT OF LIABILITY/DISCLAIMER OF WARRANTY: THE PUBLISHER AND THE AUTHOR MAKE NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS WORK AND SPECIFICALLY DISCLAIM ALL WARRANTIES, INCLUDING WITH-OUT LIMITATION WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE, NO WARRANTY MAY BE CREATED OR EXTENDED BY SALES OR PROMOTIONAL MATERIALS. THE ADVICE AND STRATEGIES CONTAINED HEREIN MAY NOT BE SUITABLE FOR EVERY SITUATION. THIS WORK IS SOLD WITH THE UNDERSTANDING THAT THE PUBLISHER IS NOT ENGAGED IN RENDERING LEGAL, ACCOUNTING, OR OTHER PROFESSIONAL SERVICES. IF PROFESSIONAL ASSISTANCE IS REQUIRED, THE SERVICES OF A COMPETENT PROFESSIONAL PERSON SHOULD BE SOUGHT. NEITHER THE PUBLISHER NOR THE AUTHOR SHALL BE LIABLE FOR DAMAGES ARISING HEREFROM. THE FACT THAT AN ORGANIZA-TION OR WEBSITE IS REFERRED TO IN THIS WORK AS A CITATION AND/OR A POTENTIAL SOURCE OF FURTHER INFORMATION DOES NOT MEAN THAT THE AUTHOR OR THE PUBLISHER ENDORSES THE INFORMATION THE ORGANIZATION OR WEBSITE MAY PROVIDE OR RECOMMENDATIONS IT MAY MAKE. FURTHER, READERS SHOULD BE AWARE THAT INTERNET WEBSITES LISTED IN THIS WORK MAY HAVE CHANGED OR DISAPPEARED BETWEEN WHEN THIS WORK WAS WRITTEN AND WHEN IT IS READ.

For general information on our other products and services, please contact our Customer Care Department within the U.S. at 877-762-2974, outside the U.S. at 317-572-3993, or fax 317-572-4002.

For technical support, please visit www.wiley.com/techsupport.

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats. For more information about Wiley products, visit us at www.wiley.com.

Library of Congress Control Number: 2011930312

ISBN 978-1-118-02152-1 (pbk); ISBN 978-1-118-03677-8 (ebk); ISBN 978-1-118-03678-5 (ebk); ISBN 978-1-118-03679-2 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2



Get More and Do More at Dummies.com®



Start with FREE Cheat Sheets

Cheat Sheets include

- Checklists
- Charts
- Common Instructions
- And Other Good Stuff!

To access the Cheat Sheet created specifically for this book, go to www.dummies.com/cheatsheet/geology

Get Smart at Dummies.com

Dummies.com makes your life easier with 1,000s of answers on everything from removing wallpaper to using the latest version of Windows.

Check out our

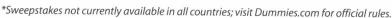
- Videos
- Illustrated Articles
- Step-by-Step Instructions

Plus, each month you can win valuable prizes by entering our Dummies.com sweepstakes.*

Want a weekly dose of Dummies? Sign up for Newsletters on

- Digital Photography
- Microsoft Windows & Office
- Personal Finance & Investing
- Health & Wellness
- · Computing, iPods & Cell Phones
- eBay
- Internet
- Food, Home & Garden

Find out "HOW" at Dummies.com





Geology FOR DUMMIES®

About the Author

Alecia M. Spooner has been teaching various Earth and Environmental Sciences for seven years. She has earned degrees in Anthropology (B.A., University of Mississippi), Archaeology (M.A., Washington State University), and Geology (M.S., University of Washington). Her research includes interdisciplinary studies of paleoecology, paleoclimatology, and archaeology. Currently she teaches at Everett Community College and enjoys developing active-learning science curricula. She lives in Shoreline, Washington, with her husband and two sons.

Dedication

This book is dedicated to my teachers and my students.

"Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less."

-Marie Curie

Author's Acknowledgments

This book could not have been written without support from the following people: Igor Tatarinov, my husband, who took on a disproportionate share of parenting so that I could spend my evening and weekends writing (I love you); my two boys who inspire in me daily a sense of wonder and awe at the world; and the network of people who keep my world in focus and on track. Thanks to my family for endless encouragement; my friends for, y'know, being *friends*, and who never for a second doubted I could pull this off; Heather, Jessica, Alison, Julie, and Beckie, who love my children as much as I do; Jani and Kysa, who keep the chaos under control; my brother Kyle for spending countless childhood summers with me "playing school" so that I could practice being a teacher; my science and teaching colleagues and mentors from whom I learn so much every day; my agent, Matt Wagner, whom I enjoy working with; and Joan Friedman, quite possibly the best editor in the world (and one who understands that sick kids warrant a slight deadline extension). Thank you all so very much.

Publisher's Acknowledgments

We're proud of this book; please send us your comments at http://dummies.custhelp.com. For other comments, please contact our Customer Care Department within the U.S. at 877-762-2974, outside the U.S. at 317-572-3993, or fax 317-572-4002.

Some of the people who helped bring this book to market include the following:

Acquisitions, Editorial, and Media Development

Project Editor: Joan Friedman

Acquisitions Editor: Lindsay Sandman Lefevere

Assistant Editor: David Lutton

Technical Editors: Abbed Babaei, PhD,

Kelly Best

Senior Editorial Manager: Jennifer Ehrlich

Editorial Supervisor: Carmen Krikorian Editorial Assistants: Rachelle S. Amick,

Alexa Koschier

Art Coordinator: Alicia B. South

Cover Photos: © iStockphoto.com/Crisma

(front cover); © iStockphoto.com/satori13,

© iStockphoto.com/Jodi Jacobson

(back cover)

Cartoons: Rich Tennant

(www.the5thwave.com)

Composition Services

Project Coordinator: Patrick Redmond

Layout and Graphics: Ronda David-Burroughs,

Cheryl Grubbs, Corrie Socolovitch

Proofreader: Evelyn Wellborn

Indexer: Sherry Massey

Publishing and Editorial for Consumer Dummies

Diane Graves Steele, Vice President and Publisher, Consumer Dummies

Kristin Ferguson-Wagstaffe, Product Development Director, Consumer Dummies

Ensley Eikenburg, Associate Publisher, Travel

Kelly Regan, Editorial Director, Travel

Publishing for Technology Dummies

Andy Cummings, Vice President and Publisher, Dummies Technology/General User

Composition Services

Debbie Stailey, Director of Composition Services

Apple & Macs

iPad For Dummies 978-0-470-58027-1

iPhone For Dummies, 4th Edition 978-0-470-87870-5

MacBook For Dummies, 3rd Edition 978-0-470-76918-8

Mac OS X Snow Leopard For Dummies 978-0-470-43543-4

Business

Bookkeeping For Dummies 978-0-7645-9848-7

Job Interviews For Dummies, 3rd Edition 978-0-470-17748-8

Resumes For Dummies, 5th Edition 978-0-470-08037-5

Starting an Online Business For Dummies, 6th Edition 978-0-470-60210-2

Stock Investing For Dummies, 3rd Edition 978-0-470-40114-9

Successful Time Management For Dummies 978-0-470-29034-7

Computer Hardware

BlackBerry For Dummies, 4th Edition 978-0-470-60700-8

Computers For Seniors For Dummies, 2nd Edition 978-0-470-53483-0

PCs For Dummies, Windows 7th Edition 978-0-470-46542-4

Laptops For Dummies, 4th Edition 978-0-470-57829-2

Cooking & Entertaining

Cooking Basics For Dummies, 3rd Edition 978-0-7645-7206-7

Wine For Dummies, 4th Edition 978-0-470-04579-4

Diet & Nutrition

Dieting For Dummies, 2nd Edition 978-0-7645-4149-0

Nutrition For Dummies, 4th Edition 978-0-471-79868-2

Weight Training For Dummies, 3rd Edition 978-0-471-76845-6

Digital Photography

Digital SLR Cameras & Photography For Dummies, 3rd Edition 978-0-470-46606-3

Photoshop Elements 8 For Dummies 978-0-470-52967-6

Gardening

Gardening Basics For Dummies 978-0-470-03749-2

Organic Gardening For Dummies, 2nd Edition 978-0-470-43067-5

Green/Sustainable

Raising Chickens For Dummies 978-0-470-46544-8

Green Cleaning For Dummies 978-0-470-39106-8

Health

Diabetes For Dummies, 3rd Edition 978-0-470-27086-8

Food Allergies For Dummies 978-0-470-09584-3

Living Gluten-Free For Dummies, 2nd Edition 978-0-470-58589-4

Hobbies/General

Chess For Dummies, 2nd Edition 978-0-7645-8404-6

Drawing Cartoons & Comics For Dummies 978-0-470-42683-8

Knitting For Dummies, 2nd Edition 978-0-470-28747-7

Organizing For Dummies 978-0-7645-5300-4

Su Doku For Dummies 978-0-470-01892-7

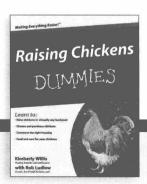
Home Improvement

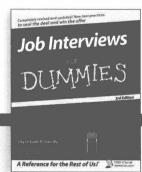
Home Maintenance For Dummies, 2nd Edition 978-0-470-43063-7

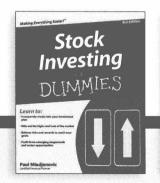
Home Theater For Dummies, 3rd Edition 978-0-470-41189-6

Living the Country Lifestyle All-in-One For Dummies 978-0-470-43061-3

Solar Power Your Home For Dummies, 2nd Edition 978-0-470-59678-4









Internet

Blogging For Dummies, 3rd Edition 978-0-470-61996-4

eBay For Dummies, 6th Edition 978-0-470-49741-8

Facebook For Dummies, 3rd Edition 978-0-470-87804-0

Web Marketing For Dummies, 2nd Edition 978-0-470-37181-7

WordPress For Dummies, 3rd Edition 978-0-470-59274-8

Language & Foreign Language

French For Dummies 978-0-7645-5193-2

Italian Phrases For Dummies 978-0-7645-7203-6

Spanish For Dummies, 2nd Edition 978-0-470-87855-2

Spanish For Dummies, Audio Set 978-0-470-09585-0

Math & Science

Algebra I For Dummies, 2nd Edition 978-0-470-55964-2

Biology For Dummies, 2nd Edition 978-0-470-59875-7

Calculus For Dummies 978-0-7645-2498-1

Chemistry For Dummies 978-0-7645-5430-8

Microsoft Office

Excel 2010 For Dummies 978-0-470-48953-6

Office 2010 All-in-One For Dummies 978-0-470-49748-7

Office 2010 For Dummies, Book + DVD Bundle 978-0-470-62698-6

Word 2010 For Dummies 978-0-470-48772-3

Music

Guitar For Dummies, 2nd Edition 978-0-7645-9904-0

iPod & iTunes For Dummies, 8th Edition 978-0-470-87871-2

Piano Exercises For Dummies 978-0-470-38765-8

Parenting & Education

Parenting For Dummies, 2nd Edition 978-0-7645-5418-6

Type 1 Diabetes For Dummies 978-0-470-17811-9

Pets

Cats For Dummies, 2nd Edition 978-0-7645-5275-5

Dog Training For Dummies, 3rd Edition 978-0-470-60029-0

Puppies For Dummies, 2nd Edition 978-0-470-03717-1

Religion & Inspiration

The Bible For Dummies 978-0-7645-5296-0

Catholicism For Dummies 978-0-7645-5391-2

Women in the Bible For Dummies 978-0-7645-8475-6

Self-Help & Relationship

Anger Management For Dummies 978-0-470-03715-7

Overcoming Anxiety For Dummies, 2nd Edition 978-0-470-57441-6

Sports

Baseball For Dummies, 3rd Edition 978-0-7645-7537-2

Basketball For Dummies, 2nd Edition 978-0-7645-5248-9

Golf For Dummies, 3rd Edition 978-0-471-76871-5

Web Development

Web Design All-in-One For Dummies 978-0-470-41796-6

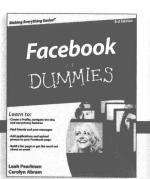
Web Sites Do-It-Yourself For Dummies, 2nd Edition 978-0-470-56520-9

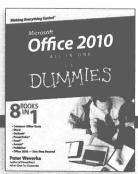
Windows 7

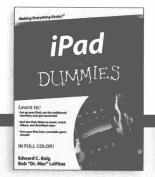
Windows 7 For Dummies 978-0-470-49743-2

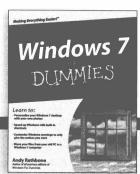
Windows 7 For Dummies, Book + DVD Bundle 978-0-470-52398-8

Windows 7 All-in-One For Dummies 978-0-470-48763-1





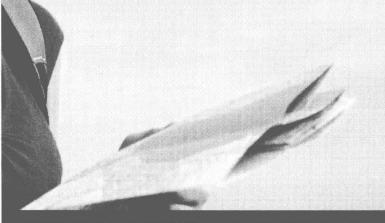




DUMMIES.GOM®

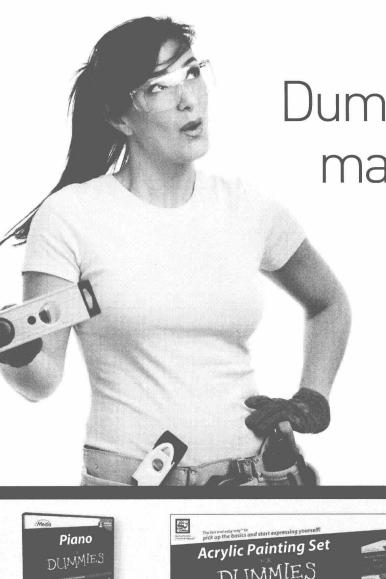






From fashion to Facebook®. wine to Windows®, and everything in between, Dummies makes it easier.

为试读, 需要完整PDF请访问: www.ertonghook com



Dummies products make life easier!

DIY • Consumer Electronics • Crafts • Software • Cookware • Hobbies • Videos • Music • Games • and More!

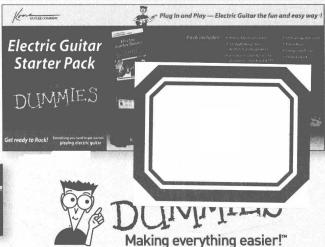
For more information, go to **Dummies.com®** and search the store by category.















Contents at a Glance

Introduction	1
Part 1: Studying the Earth	7
Chapter 1: Rocks for Jocks (and Everybody Else)	
Chapter 2: Observing Earth through a Scientific Lens	
Chapter 3: From Here to Eternity: The Past, Present, and Future of Geologic Thought	
Chapter 4: Home Sweet Home: Planet Earth	
Part 11: Elements, Minerals, and Rocks	
Chapter 5: It's Elemental, My Dear: A Very Basic Chemistry of	
Elements and Compounds	47
Chapter 6: Minerals: The Building Blocks of Rocks	
Chapter 7: Recognizing Rocks: Igneous, Sedimentary, and Metamorphic Typ	es 75
Part 111: One Theory to Explain 1t All:	
Plate Tectonics	107
Chapter 8: Adding Up the Evidence for Plate Tectonics	
Chapter 9: When Crustal Plates Meet, It's All Relative	191
Chapter 10: Who's Driving This Thing? Mantle Convection	141
and Plate Movement	139
Part IV: Superficially Speaking:	100
About Surface Processes	
Chapter 11: Gravity Takes Its Toll: Mass Wasting	
Chapter 12: Water: Above and Below Ground	165
Chapter 13: Flowing Slowly toward the Sea: Glaciers	
Chapter 14: Blowing in the Wind: Moving Sediments without Water	199
Chapter 15: Catch a Wave: The Evolution of Shorelines	211
Part V: Long, Long Ago in This Galaxy Right Here	
Chapter 16: Getting a Grip on Geologic Time	
Chapter 17: A Record of Life in the Rocks	241

Chapter 18: Time before Time Began: The Precambrian25	53
Chapter 19: Teeming with Life: The Paleozoic Era26	67
Chapter 20: It Should Have Been Called <i>Mesozoic Park:</i> When Dinosaurs Dominated28	85
Chapter 21: The Cenozoic Era: Mammals Take Over29	99
Chapter 22: And Then There Were None: Major Extinction Events in Earth's History3	15
Part VI: The Part of Tens	7
Chapter 23: Ten (Plus) Ways Humans Act as Geologic Agents33	29
Chapter 24: Ten Geologic Hazards	35
Index 34	1

Table of Contents

Introduction	1
About This Book	
Conventions Used in This Book	
What You're Not to Read	•••••••
Foolish Assumptions	•••••••
How This Book Is Organized	•
Part I: Studying the Earth	
Part II: Elements, Minerals, and Rocks	
Part III: One Theory to Explain It All: Plate Tectonics	
Part IV: Superficially Speaking: About Surface Processes	
Part V: Long, Long Ago in This Galaxy Right Here	
Part VI: The Part of Tens	
Icons Used in This Book	٠ ۲
Where to Go from Here	
Part 1: Studying the Earth	7
Chapter 1: Rocks for Jocks (and Everybody Else)	C
Finding Your Inner Scientist	
Finding Your Inner Scientist	C
Finding Your Inner Scientist	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation Understanding how rocks form	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation Understanding how rocks form Tumbling through the rock cycle	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation Understanding how rocks form Tumbling through the rock cycle Mapping Continental Movements	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation Understanding how rocks form Tumbling through the rock cycle Mapping Continental Movements Unifying geology with plate tectonics theory	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation Understanding how rocks form Tumbling through the rock cycle Mapping Continental Movements Unifying geology with plate tectonics theory Debating a mechanism for plate movements	
Finding Your Inner Scientist Making observations every day Jumping to conclusions Focusing on Rock Formation and Transformation Understanding how rocks form Tumbling through the rock cycle Mapping Continental Movements Unifying geology with plate tectonics theory Debating a mechanism for plate movements. Moving Rocks Around on Earth's Surface	
Finding Your Inner Scientist	

xii	Geology For Dummies	
	Crunching the numbers	
	Chapter 3: From Here to Eternity: The Past, Present, and Future of Geologic Thought	
	Catastrophe Strikes Again and Again	
Chapter 4: Home Sweet Home: Planet Earth		
	Earth's Spheres	

Examining Earth's Geosphere Defining earth's layers Examining each layer Part 11: Elements, Minerals, and Rocks Chapter 5: It's Elemental, My Dear: A Very Basic Chemistry	39 41
Defining earth's layers Examining each layer	39 41
Part 11: Elements, Minerals, and Rocks	41
,	45
Chanter E. It's Elemental My Door: A Very Recic Chemistry	
of Elements and Compounds	47
The Smallest Matter: Atoms and Atomic Structure	47
Charging particles: lons	51
Getting comfortable with the periodic table	48 51

Chemical Bondage for Beginners	5
Donating electrons (ionic bonds)	52
Sharing electrons (covalent bonds)	54
Migrating electrons (metallic bonds)	54
Formulating Compounds	55
Chapter 6: Minerals: The Building Blocks of Rocks	57
Meeting Mineral Requirements	58
Making Crystals	58
Identifying Minerals Using Physical Characteristics	59
Observing transparency, color, luster, and streak	59
Measuring mineral strength	60
If it tastes like salt, it must be halite: Noting unique	
mineral properties	64
Measuring properties in the lab	65
Realizing Most Rocks Are Built from Silicate Minerals	65
Finding silicates in many shapes	67
Grouping silicate minerals	70
Remembering the Nonsilicate Minerals	70
Carbonates	70
Sulfides and sulfates	71
Oxides	71
Native elements	72
Evaporites	72
Gemstones	73
Chapter 7: Recognizing Rocks: Igneous, Sedimentary, and	
Metamorphic Types	
Crystallizing One Way or Another: Igneous Rocks	76
Classifying igneous rocks	76
Mama magma: Birthing igneous rocks	79
When magma becomes lava: Studying volcanoes	83
Seeing what lies beneath: Plutons	86
Merging Many Single Grains of Sand: Sedimentary Rocks	87
Weathering rocks into sediments	89
Settle down (and be compacted)!: Changing	
from sediment into rock	91
Sizing up the grains: Classifying sedimentary rocks	93
No grains at all: Chemical sedimentary rocks	94
Telling stories of the past: Sedimentary structures	96
Stuck between a Rock and a Hard Place: Metamorphic Rock	rs98
And you thought you were stressed! Heat, pressure,	
and metamorphism	99
Grades of metamorphism and index minerals	100
	100
Between the mineral sheets: Foliation, or maybe not	100
Categorizing metamorphic rocks	100
Categorizing metamorphic rocks	100