

Contents

<i>List of Contributors</i>	<i>page</i>
	viii
1 Introduction to <i>Deep Carbon: Past to Present</i>	1
BETH N. ORCUTT, ISABELLE DANIEL, RAJDEEP DASGUPTA, DARLENE TREW CRIST, AND MARIE EDMONDS	
2 Origin and Early Differentiation of Carbon and Associated Life-Essential Volatile Elements on Earth	4
RAJDEEP DASGUPTA AND DAMANVEER S. GREWAL	
3 Carbon versus Other Light Elements in Earth's Core	40
JIE LI, BIN CHEN, MAINAK MOOKHERJEE, AND GUILLAUME MORARD	
4 Carbon-Bearing Phases throughout Earth's Interior: Evolution through Space and Time	66
VINCENZO STAGNO, VALERIO CERANTOLA, SONJA AULBACH, SERGEY LOBANOV, CATHERINE A. MCCAMMON, AND MARCO MERLINI	
5 Diamonds and the Mantle Geodynamics of Carbon: Deep Mantle Carbon Evolution from the Diamond Record	89
STEVEN B. SHIREY, KAREN V. SMIT, D. GRAHAM PEARSON, MICHAEL J. WALTER, SONJA AULBACH, FRANK E. BRENKER, HÉLÈNE BUREAU, ANTONY D. BURNHAM, PIERRE CARTIGNY, THOMAS CHACKO, DANIEL J. FROST, ERIK H. HAURI, DORRIT E. JACOB, STEVEN D. JACOBSEN, SIMON C. KOHN, ROBERT W. LUTH, SAMI MIKHAIL, ODED NAVON, FABRIZIO NESTOLA, PAOLO NIMIS, MEDERIC PALOT, EVAN M. SMITH, THOMAS STACHEL, VINCENZO STAGNO, ANDREW STEELE, RICHARD A. STERN, EMILIE THOMASSOT, ANDREW R. THOMSON, AND YAakov WEISS	
6 CO ₂ -Rich Melts in Earth	129
GREGORY M. YAXLEY, SUJOY GHOSH, EKATERINA S. KISEEVA, ANANYA MALLIK, CARL SPANDLER, ANDREW R. THOMSON, AND MICHAEL J. WALTER	

7	The Link between the Physical and Chemical Properties of Carbon-Bearing Melts and Their Application for Geophysical Imaging of Earth's Mantle	163
	FABRICE GAILLARD, NICOLAS SATOR, EMMANUEL GARDÉS, BERTRAND GUILLOT, MALCOLM MASSUYEAU, DAVID SIFRÉ, TAHAR HAMMOUDA, AND GUILLAUME RICHARD	
8	Carbon Dioxide Emissions from Subaerial Volcanic Regions: Two Decades in Review	188
	CYNTHIA WERNER, TOBIAS P. FISCHER, ALESSANDRO AIUPPA, MARIE EDMONDS, CARLO CARDELLINI, SIMON CARN, GIOVANNI CHIODINI, ELIZABETH COTTRELL, MIKE BURTON, HIROSHI SHINOHARA, AND PATRICK ALLARD	
9	Carbon in the Convecting Mantle	237
	ERIK H. HAURI, ELIZABETH COTTRELL, KATHERINE A. KELLEY, JONATHAN M. TUCKER, KEI SHIMIZU, MARION LE VOYER, JARED MARSKE, AND ALBERTO E. SAAL	
10	How Do Subduction Zones Regulate the Carbon Cycle?	276
	MATTHIEU EMMANUEL GALVEZ AND MANUEL PUBELLIER	
11	A Framework for Understanding Whole-Earth Carbon Cycling	313
	CIN-TY A. LEE, HEHE JIANG, RAJDEEP DASGUPTA, AND MARK TORRES	
12	The Influence of Nanoporosity on the Behavior of Carbon-Bearing Fluids	358
	DAVID COLE AND ALBERTO STRIOLO	
13	A Two-Dimensional Perspective on CH ₄ Isotope Clumping: Distinguishing Process from Source	388
	EDWARD D. YOUNG	
14	Earth as Organic Chemist	415
	EVERETT SHOCK, CHRISTIANA BOCKISCH, CHARLENE ESTRADA, KRISTOPHER FECTEAU, IAN R. GOULD, HILAIRY HARTNETT, KRISTIN JOHNSON, KIRTLAND ROBINSON, JESSIE SHIPP, AND LYNDA WILLIAMS	
15	New Perspectives on Abiotic Organic Synthesis and Processing during Hydrothermal Alteration of the Oceanic Lithosphere	447
	MURIEL ANDREANI AND BÉNÉDICTE MÉNEZ	
16	Carbon in the Deep Biosphere: Forms, Fates, and Biogeochemical Cycling	480
	SUSAN Q. LANG, MAGDALENA R. OSBURN, AND ANDREW D. STEEN	
17	Biogeography, Ecology, and Evolution of Deep Life	524
	CARA MAGNABOSCO, JENNIFER F. BIDDLE, CHARLES S. COCKELL, SEAN P. JUNGBLUTH, AND KATRINA I. TWING	

18	The Genetics, Biochemistry, and Biophysics of Carbon Cycling by Deep Life KAREN G. LLOYD, CODY S. SHEIK, BERTRAND GARCÍA-MORENO, AND CATHERINE A. ROYER	556
19	Energy Limits for Life in the Subsurface DOUG LAROWE AND JAN AMEND	585
20	Deep Carbon through Deep Time: Data-Driven Insights ROBERT M. HAZEN, YANA BROMBERG, ROBERT T. DOWNS, AHMED ELEISH, PAUL G. FALKOWSKI, PETER FOX, DONATO GIOVANNELLI, DANIEL R. HUMMER, GRETHE HYSTAD, JOSHUA J. GOLDEN, ANDREW H. KNOLL, CONGRUI LI, CHAO LIU, ELI K. MOORE, SHAUNNA M. MORRISON, A.D. MUSCENTE, ANIRUDH PRABHU, JOLYON RALPH, MICHELLE Y. RUCKER, SIMONE E. RUNYON, LISA A. WARDEN, AND HAO ZHONG	620
	<i>Index</i>	653

Online Resources (available at www.cambridge.org/deepcarbon)

Compilations of global volcanic CO₂ emissions (Supplemental Tables 8.1 to 8.4 to accompany Chapter 8)

Movie of molecular dynamics in magma melts (to accompany Chapter 7)