
CONTENTS

	PREFACE	ix
1	HOW THE EARTH WORKS	1
	Historical Geology 2	
	The New Revolution 3	
	Architecture of the Earth 4	
	Plate Tectonics 13	
	The Evolution of a Concept 24	
	Summary 28	
	Suggestions for Further Reading 30	
2	THE ABYSS OF TIME: Concepts and Principles of Geologic Time	31
	The Book of Time 32	
	Relative Time 34	
	Geochronology 46	
	Summary 51	
	Suggestions for Further Reading 51	
3	A MOST AMAZING CALENDAR: Birth and Development of the Geologic Time Scale	53
	Clash of Opinions: Werner and Hutton 54	
	Beginnings of Historical Geology 56	
	Growth of the Relative Time Scale 63	
	Historical Geology Matures 69	
	Summary 83	
	Suggestions for Further Reading 84	

4	DOCUMENTS OF LIFE: Preservation of Fossils and the Spectrum of Life	85
	The Way It Was 86	
	Bias of the Fossil Record 87	
	A Parade of Characters: Unicells to Plants 92	
	The Parade Continues: The Animal Kingdom 97	
	Summary 108	
	Suggestions for Further Reading 109	
5	ORGANIZING THE RECORD: The Classification and Uses of Fossils	111
	Two "Giants" 112	
	Classification of Organisms 113	
	The Importance of Fossils 116	
	Summary 127	
	Suggestions for Further Reading 127	
6	SHIFTING SANDS AND MURKY MUDS: Ancient Sedimentary Environments and Facies	129
	From Permian Sea to National Park 130	
	Rocks and Environments 131	
	The Relationship Between Facies and Environments 133	
	A Present-Day Model 140	
	The Fluctuating Shoreline 141	
	A Permian Facies Model 144	
	End Products 148	
	Summary 150	
	Suggestions for Further Reading 150	
7	THE PERVASIVENESS OF CHANGE: Evolution and Extinction	151
	Too Much Monkey Business 152	
	Mechanism of Organic Evolution 153	
	Major Features of Evolution 157	
	Crises in the History of Life 161	
	Summary 168	
	Suggestions for Further Reading 168	
8	ORIGINS OF EARTH AND ITS SPHERES	169
	Origin of Life 170	
	Beginnings 172	
	The Lithosphere 175	
	The Atmosphere and Hydrosphere 179	
	The Biosphere 180	
	Summary 183	
	Suggestions for Further Reading 183	

9	CRYPTOZOIC HISTORY: The Age of Microscopic Life	185
	Life Before Trilobites 186	
	Terminology 188	
	Geochronologic Subdivisions 188	
	Canadian Shield 192	
	Cryptozoic Rocks Outside the Shield 198	
	Evolution of the Lithosphere 206	
	Evolution of the Biosphere and the Atmosphere 208	
	Summary 220	
	Suggestions for Further Reading 222	
10	THE “EOPALEOZOIC”: Proterozoic-Paleozoic Transition	223
	The Burgess Shale Fauna 224	
	The Ediacarian System 226	
	The Earliest Cambrian History 232	
	Later Cambrian History 235	
	Early History of the Metazoa—A Separate Era? 248	
	Summary 248	
	Suggestions for Further Reading 249	
11	PALEOZOIC HISTORY	251
	America’s First Major Geologic Concept 252	
	Ordovician History 254	
	Silurian and Devonian History 261	
	Paleogeography of the Early Paleozoic World 276	
	Carboniferous History: The Mississippian and Pennsylvanian 276	
	Permian History: The Paleozoic Drama Ends 287	
	Paleogeography of the Late Paleozoic World 293	
	Summary 297	
	Suggestions for Further Reading 298	
12	MESOZOIC HISTORY	299
	The Bone Hunters 300	
	Triassic History 302	
	Jurassic History 310	
	Cretaceous History 322	
	Microplates and the Accretion of Western North America 345	
	Summary 348	
	Suggestions for Further Reading 350	
13	CENOZOIC HISTORY	351
	Conquering the Colorado 352	
	The Cenozoic Time Scale 355	
	The Western Interior 355	
	The Continent’s Trailing Edge 365	

	The Continent's Leading Edge	373
	Life of the Cenozoic	390
	"Twenty Seconds 'Til Midnight": The Pliocene and Holocene	391
	Summary	395
	Suggestions for Further Reading	396
14	MATCHSTICKS TO MAGNOLIAS: The Evolutionary History of Plants	397
	The Remains of an Ancient Petrified Forest	398
	The World of Plants	399
	Fossil Record of the Plant Kingdom	402
	Evolutionary History of Major Plant Taxa	405
	Special Applications of Paleobotany: Spores, Pollen, and Tree Rings	412
	Summary	413
	Suggestions for Further Reading	414
15	THE MEEK INHERIT THE EARTH: Evolutionary History of the Mammals	415
	Mammals and Evolutionary Theory	416
	Inauspicious Beginnings	418
	Mammals Take Center Stage	422
	A Model of Mammalian Diversity	424
	Evolutionary History of Primates	428
	Terrestrial Plant and Vertebrate Communities	429
	Summary	430
	Suggestions for Further Reading	431
16	THE BIG FREEZE: Glaciers and Glaciation	433
	Birth of a "Preposterous Hypothesis"	434
	Distribution of Glaciers	435
	The Pleistocene Ice Ages	435
	Some Unusual Effects of Glaciation	443
	Evidence of Pre-Pleistocene Glaciation	443
	Glaciation—Search for a Cause	444
	Summary	446
	Suggestions for Further Reading	447
	GLOSSARY	449
A	THE PERIODIC TABLE	458
B	A SYNOPSIS CLASSIFICATION OF ORGANISMS	460
	INDEX	463