

Unconventional Petroleum Geology

Caineng Zou

Petroleum Industry Press
Building 1, Block 2
Anhuali, Andingmenwai St.
Beijing, 100011
People's Republic of China



ELSEVIER

AMSTERDAM • BOSTON • HEIDELBERG • LONDON • NEW YORK • OXFORD
PARIS • SAN DIEGO • SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO

Preface	vii		
1. Introduction	1	4. Coalbed Methane	111
Section 1. History of Petroleum Geology	2	Section 1. Generation of Coalbed Methane	112
Section 2. Current Situation and Trend of Global Petroleum Exploration	10	Section 2. Geologic Features of the Coal Reservoir	116
Section 3. Differences between Conventional and Unconventional Petroleum Accumulations	16	Section 3. Occurrence State of Coalbed Methane and Production Mechanisms	122
Section 4. Position and Significance of Unconventional Petroleum Geology	19	Section 4. Forming and Distributing Coalbed Methane	127
2. Unconventional Continuous Petroleum Accumulation	27	Section 5. Evaluation and Selection of Coalbed Methane Resources	133
Section 1. Concept and Types of Unconventional Continuous Petroleum Accumulations	28	Section 6. Case Study	138
Section 2. Genesis and Characteristics of Unconventional Continuous Petroleum Accumulations	29	5. Shale Gas	149
Section 3. Nanometer-Scaled Pore-Throat System	44	Section 1. Connotation of Shale Gas	150
Section 4. Resource Assessment Methods of Unconventional Petroleum Deposits	48	Section 2. Characteristics of Shale Reservoir	159
Section 5. Key Technologies of Unconventional Petroleum Exploration and Development	55	Section 3. Generation and Distribution of Shale Gas	166
3. Tight-Sandstone Oil and Gas	61	Section 4. Key Techniques for Shale Gas Development	170
Section 1. Definition of Tight-Sandstone Oil and Gas	62	Section 5. Shale Gas Exploration Potential	175
Section 2. Origin of Tight-Sandstone reservoirs	67	Section 6. Typical Cases	184
Section 3. Generation and Distribution of Tight-Sandstone Oil and Gas	81	6. Carbonate Fracture-Cavity Reservoir	191
Section 4. Exploration Potential of Tight-Sandstone Oil and Gas	85	Section 1. Origins and Identification of Carbonate Fracture-Cavity Reservoir	192
Section 5. Typical Cases	87	Section 2. The Fracture-Cavity System and Units of Carbonate Reservoir	201
		Section 3. Migration Mechanism and Enrichment Factors of Hydrocarbon Accumulations in Carbonate Fracture-Cavity Reservoirs	203
		Section 4. Exploration and Development Technologies for Carbonate Fracture-Cavity Oil and Gas Accumulations	210
		Section 5. Exploration Potential and Direction of Carbonate Fracture-Cavity Hydrocarbon Resources	214
		Section 6. Case Study	216

7. Volcanic Reservoirs and Hydrocarbon Accumulations	223	Section 3. Generation and Evolution of Heavy Oil and Bitumen	315
Section 1. Volcanic Rock Classification and Tectonic Environment	224	Section 4. Mechanisms of Heavy Oil and Bitumen Accumulation and Pool Formation	319
Section 2. Genetic Mechanism of Volcanic Reservoirs	230	Section 5. Production Technologies of Heavy Oil and Bitumen	322
Section 3. Oil and Gas Accumulation and Distribution in Volcanic Reservoirs	241	Section 6. Potential and Distribution of Heavy Oil and Bitumen Resources	324
Section 4. Evaluation and Prediction of Volcanic Oil and Gas Accumulations	253	Section 7. Case Study	327
Section 5. Oil and Gas Resource Potential and Future Exploration in Volcanic Rocks	261	10. Natural Gas Hydrate	337
Section 6. Case Studies	264	Section 1. Concepts and Characteristics of Natural Gas Hydrate	337
8. Oil and Gas in Metamorphic Reservoirs	275	Section 2. Natural Gas Hydrate Thermodynamic and Kinetic Models	339
Section 1. Metamorphic Rock Type and Tectonic Setting	276	Section 3. Formation and Occurrence of Natural Gas Hydrate	346
Section 2. Origin of Metamorphic Reservoir Rocks	281	Section 4. Evaluation and Prediction for Natural Gas Hydrate and Its Energy Potential	348
Section 3. Hydrocarbon Accumulation and Enrichment Rules of Metamorphic Reservoir	288	11. Outlook on Unconventional Petroleum Resources	355
Section 4. Prediction Methods of Metamorphic Fractured Reservoirs	296	Section 1. Future Development of Unconventional Petroleum Resources	355
Section 5. Case Study	299	Section 2. Outlook on Techniques for Unconventional Petroleum Exploration and Exploitation	360
9. Heavy Oil and Bitumen	307	Index	363
Section 1. Physical and Chemical Properties and Characteristics of Heavy Oil and Bitumen	308		
Section 2. Types and Distributions of Heavy Oil and Bitumen	310		