

Contents

1 Fuel-Mineral Resource Base	1
Introduction	1
Energy Resource Base	2
Relevance of Depositional Systems to Energy Resources	3
Applications in the Environmental Arena	5
2 Approaches to Genetic Stratigraphic Analysis	6
Introduction: Depositional and Sediment Dispersal Systems	6
Applied Depositional System Analysis	9
Seismic Stratigraphy and Facies Analysis	19
Recognition of Depositional Systems: An Example	20
Base Level Change and Vertical Sequence	27
Integrated Depositional System Analysis	27
3 Alluvial Fans	29
Introduction	29
Processes Acting on Alluvial Fans	30
Spectrum of Alluvial Fan Systems	35
Fan Deltas	41
Ancient Alluvial Fan and Fan Delta Systems	45
Basin-Fill Architecture	52
Alluvial Fans Through Geologic Time	58
Resource Potential of Alluvial Fan Systems	58
4 Fluvial Systems	60
Introduction	60
Depositional Processes	60
Fluvial Environments and Facies	64
Spectrum of Fluvial Depositional Systems	77
Eroding Rivers: Stable Channel and Valley-Fill Systems	83
Fluvial Evolution Through Geologic Time	89
Ancient Fluvial Systems	89
5 Delta Systems	91
Introduction	91
Delta Process Framework	91
Delta Environments and Facies	100
Process Classification of Delta Systems	101
Fluvial-Dominated Deltas	103
Wave-Dominated Deltas	111

Tide-Dominated Deltas	115
Delta System Recognition	119
Delta System Stratigraphic Architecture	121
Evolution of Delta Systems	124
6 Shore-Zone Systems	126
Introduction	126
Spectrum of Shore-Zone Environments	127
Shore-Zone Processes	131
Shore-Zone Facies	134
Shore-Zone Depositional Systems	149
Stratigraphy of Shore-Zone Systems	154
Shore-Zone Systems Through Geologic Time	157
7 Terrigenous Shelf Systems	159
Introduction	159
Shelf Processes	160
Shelf Sediment Sources and Dispersal Patterns	167
Shelf Facies	169
Spectrum of Shelf Systems	175
Stratigraphic Architecture and Evolution of Shelf Systems	177
Shelf Systems in Marine Basin Fills	185
8 Slope and Base-of-Slope Systems	186
Introduction	186
Slope Processes	188
Bedding Architecture of Slope Systems	193
Slope Environments and Facies	195
Slope System Classification	204
Slope Systems in Time and Space	228
9 Lacustrine Systems	231
Introduction	231
Factors Controlling Lake Geometry and Hydrology	231
Stratification of the Water Column	235
Lacustrine Environments and Facies	237
Lacustrine Sequence Development	241
Lake Systems Through Geologic Time	247
10 Eolian Systems	250
Introduction	250
Supply and Transport of Eolian Sand	251
Eolian Bedforms and Structures	252
Biogenic Structures	256
Dune Types	256
Interdune Facies	259
Sand Sheets	260
Coastal Dune Fields	261
Interior Sand Seas (Ergs)	261
Eolian Sequences	265

Associations with Other Depositional Systems	268
Hydrocarbons and Minerals in Eolian Systems	268
11 Depositional Systems and Facies Within a Sequence Stratigraphic Framework	270
Introduction	270
Morphodynamics: Concepts of Regime and Grade Adjustment	272
Sequence Stratigraphic Paradigm	279
Lessons of the Quaternary – Stratigraphic Signature of High-Frequency, High-Amplitude Sea-Level Change	284
Depositional Systems and Sequences: Examples	284
Sequences in Other Kinds of Basins	295
Integration of Sequences, Systems, and Facies	296
12 Depositional Systems and Basin Hydrology	297
Introduction	297
Fundamentals of Groundwater Flow	297
Properties of the Aquifer Matrix	300
Geochemical Properties	303
Basin Geohydrology	304
Meteoric Flow Regime	306
Compactional and Thermobaric Systems	313
Hydrology of Depositional Systems	318
Example of a Confined Coastal Plain Aquifer System	324
Conclusion	326
13 Coal and Coalbed Methane	327
Introduction	327
Coal Through Geologic Time	329
Coal-Forming Depositional Environments	331
Coal Petrography and Paleoenvironment	334
Coal Rank	338
Cyclicality in Peat-Forming Environments and Coal-Bearing Strata	339
Depositional Systems and Coal	344
Geometry and Evolution of Coal Basins	363
Coal-Basin Resources	367
14 Sedimentary Uranium	371
Introduction	371
Uranium Ore Deposits	371
Classification of Uranium Deposits	372
Applications to Resource Evaluation, Exploration, and Development	386
15 Petroleum	390
Introduction	390
Distribution of Petroleum in Time and Space	390
Depositional Systems and Hydrocarbon Exploration and Production	392
Distribution of Petroleum in Depositional Systems	399
Example: Intracratonic Basin Depositional Systems and Hydrocarbon Occurrence	413

Example: Frio Depositional Systems, Northern Gulf Coast Basin	417
16 Facies Characterization of Reservoirs and Aquifers	426
Introduction	426
Types and Scales of Heterogeneity	427
Styles of Heterogeneity	427
Depositional Systems, Genetic Facies, and Fluid Flow	436
Sequence Stratigraphic Applications to Reservoir and Aquifer Characterization	443
Summary	444
References	445
Subject Index	485