

# Contents

## Introduction

|   |   |
|---|---|
| Cycles and Events in Stratigraphy – Basic Concepts and Terms<br>G. Einsele, W. Ricken, and A. Seilacher ..... | 1 |
|---|---|

## Part I Structure of Individual Beds

---

### Chapter 1 Rhythmic Stratification: the “Undistorted” Record of Periodic Environmental Fluctuations

|   |     |
|---|-----|
| 1.1 Limestone-Marl Alternations – an Overview<br>G. Einsele and W. Ricken .....   | 23  |
| 1.2 Orbital Cyclicity in Mesozoic Strata<br>A.G. Fischer .....  | 48  |
| 1.3 Pelagic Black Shale-Carbonate Rhythms:<br>Orbital Forcing and Oceanographic Response<br>P.L. de Boer .....                                | 63  |
| 1.4 Environmental Factors Controlling Cretaceous Limestone-Marlstone<br>Rhythms<br>D.L. Eicher and R. Diner .....                             | 79  |
| 1.5 Rhythmic Carbonate Content Variations in Neogene Sediments<br>Above the Oceanic Lysocline<br>L. Diester-Haass .....                       | 94  |
| 1.6 Carbonate Cycles in the Pacific:<br>Reconstruction of Saturation Fluctuations<br>J. Grötsch, G. Wu, and W.H. Berger .....                 | 110 |
| 1.7 A Holistic Geochemical Approach to Cyclomania:<br>Examples from Cretaceous Pelagic Limestone Sequences<br>M.A. Arthur and W.E. Dean ..... | 126 |

|   |     |
|---|-----|
| 1.8 Variation of Sedimentation Rates in Rhythmically Bedded Sediments: Distinction Between Depositional Types<br>W. Ricken .....                          | 167 |
| 1.9 Sedimentary Rhythms in Lake Deposits<br>C. R. Glenn and K. Kelts .....  | 188 |
| <b>Chapter 2 Event Stratification: Records of Episodic Turbulence</b>   |     |
| 2.1 Events and Their Signatures – an Overview<br>A. Seilacher .....   | 222 |
| 2.2 Shallow Marine Storm Sedimentation –<br>the Oceanographic Perspective<br>D. Nummedal .....  | 227 |
| 2.3 Storm Deposition at the Bed, Facies, and Basin Scale:<br>the Geologic Perspective<br>A. Seilacher and T. Aigner .....                                 | 249 |
| 2.4 Taphonomic Feedback (Live/Dead Interactions) in the Genesis<br>of Bioclastic Beds: Keys to Reconstructing Sedimentary Dynamics<br>S. M. Kidwell ..... | 268 |
| 2.5 Fossil Lagerstätten:<br>a Taphonomic Consequence of Event Sedimentation<br>C. E. Brett and A. Seilacher .....   | 283 |
| 2.6 Secular Changes in Phanerozoic Event Bedding<br>and the Biological Overprint<br>J. J. Sepkoski Jr, R. K. Bambach, and M. L. Droser .....              | 298 |
| 2.7 Submarine Mass Flow Deposits and Turbidites<br>G. Einsele .....   | 313 |
| 2.8 Calcareous Turbidites and Their Relationship<br>to Sea-Level Fluctuations and Tectonism<br>G. P. Eberli .....   | 340 |
| 2.9 Fine-Grained Turbidites<br>D. J. W. Piper and D. A. V. Stow .....   | 360 |
| 2.10 Distinction of Tempestites and Turbidites<br>G. Einsele and A. Seilacher .....   | 377 |

|   |     |
|---|-----|
| Contents  | XI  |
| 2.11 Flash Flood Conglomerates<br>F. Pflüger and A. Seilacher .....   | 383 |
| 2.12 Tephra Layers and Tephra Events<br>H.-U. Schmincke and P. van den Bogaard .....  | 392 |
| <br><b>Chapter 3 The Diagenetic Overprint: Enhancement Versus<br/>Obliteration of Primary Signals in Calcareous Rocks</b>   |     |
| 3.1 Diagenetic Modification of Calcareous Beds – an Overview<br>W. Ricken and W. Eder .....   | 430 |
| 3.2 Pressure-Dissolution and Limestone Bedding:<br><i>the Influence of Stratified Cementation</i><br>R. G. C. Bathurst .....  | 450 |
| <br><b>Chapter 4 Cherts and Phosphorites:<br/>Primary and Diagenetic Bedding in Special Environments</b>  |     |
| 4.1 Rhythmic Bedding in Siliceous Sediments – an Overview<br>K. Decker .....  | 464 |
| 4.2 Compaction and Cementation in Siliceous Rocks<br>and Their Possible Effect on Bedding Enhancement<br>R. Tada .....  | 480 |
| 4.3 Stratification in Phosphatic Sediments:<br><i>Illustrations from the Neogene of California</i><br>K. B. Föllmi, R. E. Garrison, and K. A. Grimm .....                         | 492 |
| <br><b>Chapter 5 Preservation and Biological Destruction of Laminated Sediments</b>   |     |
| 5.1 Stratification in Black Shales:<br><i>Depositional Models and Timing – an Overview</i><br>A. Wetzel .....   | 508 |
| 5.2 Redox-Related Benthic Events<br>C. E. Savrda, D. J. Bottjer, and A. Seilacher .....   | 524 |
| 5.3 Biofacies Models for Oxygen-Deficient Facies<br><i>in Epicontinental Seas: Tool for Paleoenvironmental Analysis</i><br>B. B. Sageman, P. B. Wignall, and E. G. Kauffman ..... | 542 |

|   |     |
|---|-----|
| 5.4 Anaerobic – Poikiloaerobic – Aerobic:<br>a New Facies Zonation for Modern and Ancient Neritic Redox Facies<br>W. Oschmann ..... | 565 |
| 5.5 Cyclical Deposition of the Plattenkalk Facies<br>Ch. Hemleben and N.H.M. Swinburne .....  | 572 |
| 5.6 Biolaminations – Ecological Versus Depositional Dynamics<br>G. Gerdes, W.E. Krumbein, and H.-E. Reineck .....                   | 592 |

## **Part II Larger Cycles and Sequences**

---

|  |     |
|--|-----|
| Introductory Remarks<br>G. Einsele and W. Ricken ..... | 611 |
|--|-----|

### **Chapter 6 Sequences: Hierarchies, Causes, and Environmental Expression**

|  |     |
|--|-----|
| 6.1 The Stratigraphic Signatures<br>of Tectonics, Eustacy and Sedimentology – an Overview<br>P.R. Vail, F. Audemard, S.A. Bowman, P.N. Eisner, and C. Perez-Cruz | 617 |
| 6.2 Asymmetry in Transgressive-Regressive Cycles in Shallow Seas<br>and Passive Continental Margin Settings<br>G. Einsele and U. Bayer .....                     | 660 |
| 6.3 Condensed Deposits in Siliciclastic Sequences:<br>Expected and Observed Features<br>S.M. Kidwell .....   | 682 |
| 6.4 Biological and Evolutionary Responses<br>to Transgressive-Regressive Cycles<br>G.R. McGhee Jr, U. Bayer, and A. Seilacher .....                              | 696 |
| 6.5 Lagoonal-Peritidal Sequences in Carbonate Environments:<br>Autocyclic and Allocyclic Processes<br>A. Strasser .....  | 709 |
| 6.6 A Basic Model for Lofer Cycles<br>J. Haas .....  | 722 |
| 6.7 Coal Cyclothems and Some Models for Their Origin<br>W. Riegel .....  | 733 |

6.8 Cycles, Rhythms, and Events  
 on High Input and Low Input Glaciated Continental Margins  
 R. Henrich ..... 751

**Chapter 7 Timing and Correlation**

7.1 Time Span Assessment – an Overview  
 W. Ricken ..... 773

7.2 High-Resolution Correlation: a New Tool in Chronostratigraphy  
 E.G. Kauffman, W.P. Elder, and B.B. Sageman ..... 795

7.3 Varves, Beds, and Bundles in Pelagic Sequences  
 and Their Correlation (Mesozoic of SE France and Atlantic)  
 P. Cotillon ..... 820

7.4 The Spectral Analysis of Stratigraphic Time Series  
 G.P. Weedon ..... 840

7.5 Milankovitch Cycles and the Measurement of Time  
 W. Schwarzacher ..... 855

**References** ..... 865

**Subject Index** ..... 945