

Contents

Rationale	IX
About the author	XI
Acknowledgements	XII
Section A – Micropaleontology; preliminary concepts and generalities..	1
Chapter 1: Preliminary concepts	3
1.1 Science and non-science	3
1.2 Fossils, fossilization and the fossil record	4
1.3 Geological time	5
1.4 Lithostratigraphy, time-rock stratigraphy and time stratigraphy	8
1.5 Sedimentary environments and organism mode of life	9
1.6 Theory of Evolution in paleontology	10
1.7 Taxonomy and classification methods in paleontology	11
1.8 Typification	13
1.9 The concept of species and species evolution	14
1.10 Major crises in the history of life	16
Chapter 2: Micropaleontology and microfossils	19
2.1 Microfossils	19
2.2 Birth of micropaleontology as science	20
2.3 Studying microfossils	22
2.4 Microfossil classification	24
2.5 Micropaleontological data: sources and nature	26
2.6 Elements of biostratigraphy	27
Section B – Prokaryotes	31
Chapter 3: Division Bacteriophyta	33
Chapter 4: Division Cyanophyta	35
4.1 Fossil cyanophytes and their role in hydrocarbon source rock formation	35
4.2 Stromatolites and their role in life evolution	37
4.3 Oncolites	40
Section C – Plant-like protistans	43
Chapter 5: Division Rhodophyta	45
5.1 Milestones in the rhodophyte early evolution	45
5.2 Thallus morphology	46
5.3 Paleobathymetry and role in sediment formation	47

IV Contents

Chapter 6: Division Pyrrophyta	51
6.1 Class Dinophyceae.....	51
6.1.1 Theca morphology.....	52
6.1.2 Cyst morphology	54
6.1.3 Classification	56
6.1.4 Stratigraphical distribution, evolution and biostratigraphy	58
6.2 Class Ebriophyceae.....	62
6.2.1 Skeleton morphology.....	63
6.2.2 Classification	65
6.2.3 Evolution and biostratigraphy	66
Chapter 7: Division Chrysophyta.....	67
7.1 Class Chrysophyceae	67
7.2 Class Silicoflagellatophyceae.....	69
7.2.1 Skeleton chemistry and morphological features.....	70
7.2.2 Classification	73
7.2.3 Paleoecology and role in sediment formation	74
7.2.4 Fossil record, major evolutionary trends and biostratigraphy	74
Chapter 8: Division Bacillariophyta.....	77
8.1 Frustule chemical composition and architecture.....	78
8.2 Classification.....	80
8.3 Fossil record, evolution and biostratigraphy.....	80
8.4 Role in sediment formation.....	84
Chapter 9: Division Haptophyta.....	86
9.1 Class Coccolithophyceae	86
9.2 Coccolith composition and mineralogy	87
9.3 Coccolith morphology	87
9.3.1 Heterococcoliths.....	88
9.3.2 Holococcoliths.....	90
9.3.3 Nannoliths.....	91
9.4 Cocosphere morphology	93
9.5 Classification.....	97
9.6 Evolution and role in sediment formation	98
9.7 Biostratigraphy.....	99
Chapter 10: Division Prasinophyta	101
10.1 Phycoma morphology	102
10.2 Phycoma role in sediment formation	102

Chapter 11: Division Chlorophyta	103
11.1 Class Chlorophyceae	104
11.2 Class Codiophyceae	106
11.3 Class Bryopsidophyceae	106
11.3.1 Order Bryopsidales	106
11.3.2 Order Dasycladales	108
Chapter 12: Division Charophyta	113
12.1 Thallus morphology	113
12.2 Classification	116
12.3 Biostratigraphy and sequence stratigraphy	117
Section D – Animal-like protistans	121
Chapter 13: Order Arcellinida (phylum Sarcodina)	123
Chapter 14: Order Euglyphida (phylum Sarcodina)	125
Chapter 15: Class Foraminifera (phylum Sarcodina)	127
15.1 The beginnings of foraminiferal studies	128
15.2 Test nature and mineralogical composition	130
15.3 Test architecture	134
15.3.1 Chamber shape and arrangement	137
15.3.2 Main aperture	141
15.3.3 Sutures and pseudosutures	142
15.3.4 Test views and symmetry	142
15.3.5 Periapertural structures	146
15.3.6 Relict and supplementary apertures	146
15.3.7 Ornamentation and test wall porosity	147
15.4 Classification	151
15.5 Evolution	167
15.6 Biostratigraphy	169
Chapter 16: Class Radiolaria (phylum Sarcodina)	175
16.1 Subclass Polycystina	175
16.1.1 Skeleton architecture and symmetry	176
16.1.2 Classification	180
16.1.3 Role in sediment formation	185
16.1.4 Stratigraphic distribution and biostratigraphy	185
16.2 Subclass Phaeodaria	188
16.3 Subclass Acantharia	191
Chapter 17: Phylum Ciliophora	193
17.1 Lorica morphology	194
17.2 Lorica composition and fossil record	194
17.3 Biostratigraphy and evolution	198

Chapter 18: Phylum Choanoflagellata	201
Section E – Fungi and plants	203
Chapter 19: Kingdom Fungi	205
Chapter 20: Spores and pollen	207
20.1 Chemical composition and wall ultrastructure	208
20.2 Spore morphology	209
20.3 Pollen morphology	212
20.4 Classification	215
20.5 Geological occurrence, evolution and applications	217
Chapter 21: Class Angiospermae; family Poaceae	221
Section F – Invertebrates	223
Chapter 22: Metazoan embryos	225
Chapter 23: Phylum Porifera	227
23.1 Microscleres and macroscleres	227
23.2 Classification	229
23.3 Earliest sponges: true microfossils	230
Chapter 24: Phylum Conulata	232
Chapter 25: Phylum Cnidaria	235
25.1 Subclass Octocoralia	235
Chapter 26: Superphylum Lophophorata	238
26.1 Phylum Brachiopoda	238
26.2 Phylum Bryozoa	239
Chapter 27: Phylum Mollusca	243
27.1 Juvenile molluscs	244
27.2 Class Helcionelloida	245
27.3 Class Gastropoda; superfamily Pterotracheoidea	246
27.4 Class Gastropoda; order Thecosomata	247
27.5 Class Bivalvia; family Inoceramidae	248
27.6 Class Cephalopoda; subclasses Nautiloidea and Ammonoidea	249
27.7 Class Cephalopoda; subclass Coleoidea	251
Chapter 28: Phylum Coniconcha	252
Chapter 29: Phylum Hyolitha	254
Chapter 30: Phylum Annelida	256
30.1 Class Polychaeta; order Eunicida	256

Chapter 31: Phylum Arthropoda, excepting ostracods	258
31.1 Superclass Trilobitomorpha; order Agnostida	258
31.2 Superclass Crustacea.....	260
31.2.1 Class Branchiopoda; order Conchostraca.....	260
31.2.2 Class Cirripedia	261
31.2.3 Class Malacostraca, order Mysidacea	263
31.2.4 Class Malacostraca, order Decapoda.....	264
31.3 Superclass Hexapoda; class Insecta	265
31.4 Earliest land arthropods	268
Chapter 32: Phylum Arthropoda, class Ostracoda.....	270
32.1 Carapace components, composition and orientation	272
32.2 Carapace internal features.....	274
32.2.1 Free margin morphology	274
32.2.2 Hinge	275
32.2.3 Soft body impressions	277
32.3 Carapace external features	279
32.3.1 Outlines.....	279
32.3.2 Surface lobation, sulcation and truncation	280
32.3.3 Ornamentation	281
32.4 Sexual dimorphism	282
32.5 Carapace porosity.....	283
32.6 Classification.....	283
32.6.1 Order Archaeocopida.....	284
32.6.2 Order Leperditicopida	284
32.6.3 Order Palaeocopida	285
32.6.4 Order Podocopida.....	285
32.6.5 Order Platycopida.....	288
32.6.6 Order Myodocopida.....	289
32.7 Ecology and paleoecology	291
32.8 Major trends in ostracod evolution	293
Chapter 33: Phylum Chaetognatha.....	295
Chapter 34: Phylum Echinodermata	296
34.1 Class Crinoidea	298
34.2 Class Asteroidea.....	299
34.3 Class Ophiuroidea.....	299
34.4 Class Echinoidea.....	299
34.5 Class Holothuroidea.....	301
Section G – Chordates and vertebrates	305
Chapter 35: Phylum Tunicata.....	307

Chapter 36: Phylum Conodonta	309
36.1 Conodont element composition and morphology	310
36.1.1 Coniform conodont elements	311
36.1.2 Ramiform conodont elements.....	313
36.1.3 Pectiniform conodont elements	314
36.2 Conodont element internal structure and growth.....	315
36.3 Morphology of the whole chewing apparatus.....	317
36.4 Classification.....	318
36.5 Paleoeology	320
36.6 Evolution and biostratigraphy.....	323
Chapter 37: Superclass Pisces	325
37.1 Teeth.....	326
37.2 Dermal sclerites	327
37.3 Otoliths.....	328
Chapter 38: Class Reptilia; order Dinosauria	329
Chapter 39: Class Mammalia	331
39.1 Mammalian tooth composition, morphology and orientation.....	331
39.2 Order Multituberculata.....	333
Section H – Microproblematica	335
Chapter 40: Microproblematica and incertae sedis taxa	337
Chapter 41: Group incertae sedis Acritarcha	339
41.1 Vesicle morphology	341
41.2 Classification.....	343
41.3 Paleoeology and stratigraphical distribution	344
Chapter 42: Group incertae sedis Chitinozoa	348
42.1 Vesicle morphology	348
42.2 Chitinozoan systematic position	351
42.3 Classification.....	352
42.4 Paleoeology, biostratigraphy and evolution	352
Cited references	355
Index of Generic Names	393