

CONTENTS

Summary	1
Introduction	3
Chapter 1 The Geology of South Limburg in 1859	11
1.1 Stratigraphy	12
1.2 Litho- and biofacies	16
1.2.1 Formation Houllière	17
1.2.2 Sable D'Aix la Chapelle	17
1.2.3 Sables Verts à <i>Belemnitella quadrata</i>	18
1.2.4 Craie Blanche, Marnes et Craie à Silex	18
1.2.5 Craie Tuffeau, système Maestrichtien de Dumont	19
1.2.6 Pierres Cornées et Orgues Géologiques	21
Chapter 2 Present-day Views on Chalk	23
2.1 Particle composition of Chalk	25
2.2 Paleogeography	26
2.3 Sequence thickness and rates of deposition	27
2.4 Sea level, tectonics and depth of deposition	28
2.5 Stratigraphy	33
2.6 Paleoecology	34
2.7 Diagenesis	35
Chapter 3 Early Diagenesis of Chalk	37
3.1 The Chalk of the Lixhe 3 Member	39
3.2 <i>Bathichnus paramoudrae</i>	40
3.3 Earlier interpretations of <i>Bathichnus paramoudrae</i>	41
3.4 Re-interpretation of <i>Bathichnus paramoudrae</i>	43

3.5	Bacterial metabolism and authigenesis	44
3.5.1	Aerobic zone with dissolved oxygen	45
3.5.2	Suboxic zone of manganese reduction	45
3.5.3	Suboxic zone of iron reduction	46
3.5.4	Anoxic zone of sulphate reduction	46
3.5.5	Anoxic zone of carbondioxide reduction	46
Chapter 4	Origin and Growth of Flint Nodules	51
4.1	The morphology of flint nodules	54
4.2	The chemistry of silica in calcareous sediment	55
4.3	The numerical simulation of flint nodule growth	57
4.3.1	Initial conditions	60
4.3.2	Reaction	60
4.3.3	Diffusion	61
4.3.4	Simulation results	62
Chapter 5	The Genesis of Flint Nodule Layers	67
5.1	Quantification of the silica distribution	70
5.2	Flint cycles	72
5.3	Early diagenetic origin of flint nodule layers	73
5.4	Late diagenetic genesis of flint nodule layers	74
5.5	Reconstruction of the depositional environment	74
5.6	Numerical simulation of flint nodule layer genesis	77
5.6.1	Simulation results	79
	Appendix A - Numerical model	83
	Appendix B - Data	86
Chapter 6	The Genesis of Tempestite Cycles	91
6.1	Litho-/biofacies	95
6.1.1	Lanaye Member	95
6.1.2	Valkenburg Member	97
6.1.3	Gronsveld Member	99
6.1.4	Lateral facies changes	99
6.2	Analysis of samples	99
6.2.1	Element oxides	100
6.2.2	Microfacies	101
6.2.3	Grainsize	102
6.3	Cycle types	103
6.4	Depositional conditions	103
6.5	Early diagenetic conditions	105

6.6	Cycle genesis	107
6.7	Numerical simulation of the genesis of cycles	107
6.7.1	Simulation results	110
6.7.2	Lateral variation of cycles	114
	Appendix C - Numerical model	117
	Appendix D - Data	119
Chapter 7	The Genesis of Hardgrounds	121
7.1	Litho-/biofacies	124
7.1.1	Lower part of the successions	124
7.1.2	Middle part of the successions	124
7.1.3	Upper part of the successions	126
7.2	Syn-depositional lithification of Chalk	129
7.3	Relation between lithification and hydrodynamics	134
7.4	Numerical simulation of wavy bedding	135
7.4.1	Simulation results	137
	Appendix E - Numerical model	141
Chapter 8	Genesis of the K/T Section of Stevns Klint	143
8.1	Litho-/biofacies	145
8.1.1	The Maastrichtian White Chalk	145
8.1.2	The Danian Fish Clay and Cerithium Limestone	146
8.1.3	The Danian Bryozoan Limestone	148
8.1.4	Lateral changes in the Stevns Klint section	148
8.2	Summary of the Sedimentology of Chalk	148
8.3	Sedimentary conditions during the K/T transition	150
Chapter 9	Self-organizing Model for Wavy Bedform Genesis	157
9.1	The genesis of sediment waves	158
9.2	Cellular automaton for sediment wave genesis	160
9.2.1	Simulation results	164
9.2.2	Variation of discharge, depth, and deposition	164
9.2.3	Simultaneous lithification	167
Epilogue		173
References		175
Subject Index		191