

Contents

List of figures	ix	5.4 Northeastern Spitsbergen, Wilhelmøya and Hinlopenstretet	77
List of tables	xiii	5.5 Southwestern Nordaustlandet	80
List of photographs	xiii	5.6 Kong Karls Land (with S. R. A. Kelly)	83
Preface	xv	5.7 Barentsøya, Edgeøya and Tusenøyane	86
Acknowledgements	xvii	5.8 Hopen	91
Participants	ixx	5.9 Correlation of four exploratory wells: Edgeøya and Hopen	93
Conventions	xxi		
PART 1 Introduction		CHAPTER 6 NORTHERN NORDAUSTLANDET	96
CHAPTER 1 SVALBARD	3	6.1 Early work	96
1.1 Geographical names	3	6.2 Stratal succession	96
1.2 Topography and bathymetry	7	6.3 Subjacent metamorphic complex	104
1.3 The physical environment	8	6.4 Late tectonic plutons	105
1.4 The biota	10	6.5 Minor igneous bodies	106
1.5 Political history	11	6.6 Summary of isotopic ages	106
1.6 The Spitsbergen Treaty	11	6.7 Structure of Nordaustlandet	107
1.7 Settlements	13	6.8 The Lomonosov Ridge in relation to Nordaustlandet	108
1.8 Official publications	13		
CHAPTER 2 OUTLINE HISTORY OF GEOLOGICAL RESEARCH	16	CHAPTER 7 NORTHEASTERN SPITSBERGEN	110
2.1 Early exploration	16	7.1 Geological frame	110
2.2 1858 to 1920	16	7.2 Younger (cover) rocks	112
2.3 1920 to 1945	18	7.3 Post-Permian deformation	112
2.4 1946 to 1960	19	7.4 Ny Friesland plutons	112
2.5 1960 to 1975	20	7.5 The Hecla Hoek Complex: the continuing debate	113
2.6 1975 onwards	21	7.6 Hinlopenstretet Supergroup	116
		7.7 Lomfjorden Supergroup	118
CHAPTER 3 SVALBARD'S GEOLOGICAL FRAME	23	7.8 Stubendorffbreen Supergroup: succession	121
3.1 The space frame: Svalbard's structural frame	23	7.9 Stubendorffbreen Supergroup: genesis	125
3.2 The time frame	25	7.10 The Hecla Hoek Complex: mid-Paleozoic structure and metamorphism	128
3.3 The rock frame	29		
3.4 Tectonostratigraphic sequences	31	CHAPTER 8 NORTHWESTERN SPITSBERGEN	132
3.5 Geotectonic interpretations	37	8.1 Cenozoic volcanic rocks of the Woodfjorden area	133
		8.2 Mesozoic, Permian and Carboniferous cover	134
PART 2 Regional descriptions		8.3 Liefde Bay Supergroup (Devonian)	135
CHAPTER 4 THE CENTRAL BASIN	47	8.4 The 'crystalline' rocks of Northwestern Spitsbergen	142
4.1 Geological frame	47	8.5 Structure	145
4.2 Van Mijenfjorden Group (Paleogene)	48	8.6 Offshore geology (with P.A. Doubleday)	152
4.3 Adventdalen Group (Cretaceous–Jurassic) (by S. R. A. Kelly)	52		
4.4 Kapp Toscana and Sassendalen Groups (Liassic–Triassic) (with I. Geddes)	59	CHAPTER 9 CENTRAL WESTERN SPITSBERGEN	154
4.5 Bünsow Land Supergroup (Permian–Carboniferous)	63	9.1 Paleogene strata	154
4.6 Tempelfjorden Group (Permian) with I. Geddes & P.A. Doubleday	63	9.2 Mesozoic strata of Oscar II Land	158
4.7 Gipsdalen Group (Permian–Carboniferous) with I. Geddes & P. A. Doubleday	66	9.3 Late Paleozoic strata of Oscar II Land	159
4.8 Billefjorden Group (Early Carboniferous) with I. Geddes & P. A. Doubleday	71	9.4 Early Paleozoic rocks	162
4.9 Structure and development of Central Basin	73	9.5 Proterozoic strata of Oscar II Land	165
		9.6 Pre-Carboniferous rocks of Prins Karls Forland	166
CHAPTER 5 EASTERN SVALBARD PLATFORM	75	9.7 Structure of Oscar II Land (with P. A. Doubleday)	168
5.1 Platform strata	75	9.8 Structure of Prins Karls Forland	171
5.2 Igneous rocks	76	9.9 Structure of Forlandsundet Basin (with P. A. Doubleday)	175
5.3 Submarine outcrops	76	9.10 A tectonic interpretation of the West Spitsbergen Orogen: northern segment	177
		CHAPTER 10 SOUTHWESTERN AND SOUTHERN SPITSBERGEN	179
		10.1 Paleogene strata	180
		10.2 Mesozoic strata in southwest Sørkapp Land	182

vi	CONTENTS	
10.3	Permian and Carboniferous strata of southern Spitsbergen	183
10.4	Devonian strata	187
10.5	Proterozoic strata of western Nordenskiöld Land	188
10.6	Proterozoic strata of western Nathorst and northwestern Wedel Jarlsberg Lands	189
10.7	Early Paleozoic and Proterozoic strata of southwestern Wedel Jarlsberg Land	191
10.8	Early Paleozoic and Proterozoic strata of Sørkapp Land	197
10.9	Pre-Devonian correlation through southwest Spitsbergen	199
10.10	Structure of western Nordenskiöld Land	200
10.11	Structure of western Nathorst Land	201
10.12	Structure of Wedel Jarlsberg Land (with P. A. Doubleday)	201
10.13	Structure of Sørkapp Land (with P. A. Doubleday)	205
CHAPTER 11 SOUTHERN SVALBARD: BJØRNØYA AND SUBMARINE GEOLOGY		209
11.1	Early work	210
11.2	Geologic frame of Bjørnøya	212
11.3	Triassic strata of Bjørnøya	212
11.4	Late Paleozoic strata of Bjørnøya (with I. Geddes)	213
11.5	Pre-Devonian strata of Bjørnøya	218
11.6	Structural sequence of Bjørnøya	219
11.7	Submarine outcrops	222
11.8	Submarine structure (with P. A. Doubleday)	222
PART 3 Historical Synthesis		
CHAPTER 12 PRE-VENDIAN HISTORY		227
12.1	Precambrian time scales	229
12.2	Pre-Vendian rock successions	229
12.3	Pre-Vendian biotas (by N. J. Butterfield)	231
12.4	Precambrian isotopic ages	235
12.5	Tectonostratigraphic evidence for proto-basement	236
12.6	Pre-Vendian correlation	239
12.7	Palinspastic considerations	240
CHAPTER 13 VENDIAN HISTORY		244
13.1	Vendian time scale and correlation	244
13.2	Vendian successions and correlation in Svalbard	246
13.3	Vendian biotas	248
13.4	Vendian environments	249
13.5	Vendian international correlation	252
13.6	Vendian palinspastic discussion	254
CHAPTER 14 CAMBRIAN–ORDOVICIAN HISTORY		257
14.1	Cambrian–Ordovician time scale	260
14.2	Cambrian–Ordovician biotas and correlation	260
14.3	Cambrian–Ordovician sedimentary environments	264
14.4	Cambrian–Ordovician tectonic environments	266
14.5	Cambrian–Ordovician terranes and palinspastics	268
CHAPTER 15 SILURIAN HISTORY		272
15.1	Silurian time	272
15.2	Silurian supracrustal events: sedimentation and tectonics	275
15.3	Silurian tectogenesis	275
15.4	Silurian petrogenesis of crystalline rocks	280
15.5	Silurian terranes, provinces and palinspastics	284
15.6	Sequence of Silurian (main Caledonian) events	288
CHAPTER 16 DEVONIAN HISTORY		289
16.1	Devonian time scale and correlation	289
16.2	Devonian succession	291
16.3	Devonian biotas	291
16.4	?Silurian and Devonian sedimentation	296
16.5	Devonian tectonics	299
16.6	The question of sinistral Paleozoic strike-slip faulting, transpression and transtension	303
16.7	Sequence of events through Devonian time	306
16.8	A Lomonosov conjecture	309
CHAPTER 17 CARBONIFEROUS–PERMIAN HISTORY		310
17.1	Early work	310
17.2	Stratigraphic frame: Bünsow Land Supergroup	312
17.3	Structural frame	314
17.4	Carboniferous and Permian time scale	316
17.5	Carboniferous–Permian sedimentary environments (by I. Geddes)	318
17.6	Carboniferous–Permian fossil record	324
17.7	Carboniferous–Permian tectonic control of sedimentation (with I. Geddes)	328
17.8	Carboniferous and Permian palaeogeology	335
CHAPTER 18 TRIASSIC HISTORY		340
18.1	Early work	340
18.2	Structural frame	343
18.3	Triassic rock units	344
18.4	Triassic time scale and international correlation (with I. Geddes)	350
18.5	Triassic biotas	353
18.6	Sequence of Triassic environments (with I. Geddes)	356
18.7	Triassic regional palaeogeology	361
CHAPTER 19 JURASSIC–CRETACEOUS HISTORY		363
19.1	Early work	363
19.2	Jurassic–Cretaceous structural frame	365
19.3	stratigraphic scheme	366
19.4	Jurassic–Cretaceous time scale and correlation (with S. R. A. Kelly)	368
19.5	Jurassic–Cretaceous formations	372
19.6	Jurassic–Cretaceous biotas	378
19.7	Jurassic–Cretaceous events in Svalbard events (with S. R. A. Kelly)	381
19.8	Svalbard in a Jurassic–Cretaceous regional context	383
CHAPTER 20 PALEOGENE HISTORY		388
20.1	Early work	388
20.2	Structural and stratigraphic frame	390
20.3	Paleogene time scale and correlation	391
20.4	Paleogene biotas of Svalbard	393
20.5	Paleogene sedimentation and tectonics	394
20.6	Paleogene structures (with A. Challinor & P. A. Doubleday)	399
20.7	Structural sequence	410
20.8	Regional tectonic sequence	413
20.9	Paleogene tectosedimentary history	413
CHAPTER 21 NEOGENE–QUATERNARY HISTORY		418
21.1	Neogene–Quaternary time scale	418
21.2	Plate motions (by C. F. Stephens)	418
21.3	Deep structure of Svalbard	421
21.4	Neogene–Holocene volcanism and thermal springs (by C.F. Stephens)	423

CONTENTS

vii

21.5 Neogene and Pleistocene sedimentation (with C.F. Stephens)	426	PART 4	
21.6 Neogene–Holocene uplift and erosion	427	23 APPENDIX: ECONOMIC GEOLOGY	449
21.7 Glacial history of Svalbard: Neogene–Holocene (with C.F. Stephens)	429	23.1 Coal	449
21.8 Pleistocene and Holocene surficial geology and geomorphic features	431	23.2 Petroleum (with A. M. Spencer)	251
21.9 Post-glacial sea-level and climatic changes	434	23.3 Metalliferous minerals	253
		23.4 Non-metalliferous minerals	254
		INDEX OF PLACE NAMES (by L. M. Anderson)	455
CHAPTER 22 MODERN GLACIERS AND CLIMATE CHANGE (by E. K. Dowdeswell and J. A. Dowdeswell)	436	GLOSSARY OF STRATIGRAPHIC NAMES	463
22.1 Introduction	436	REFERENCES	477
22.2 Modern ice cover	436	GENERAL INDEX	515
22.3 Geophysical characteristics and ice dynamics	438		
22.4 Ice–ocean interaction	442		
22.5 Late Holocene glacial events and chronology	443		
22.6 Glaciers and climatic change	444		
22.7 Summary and conclusions	445		