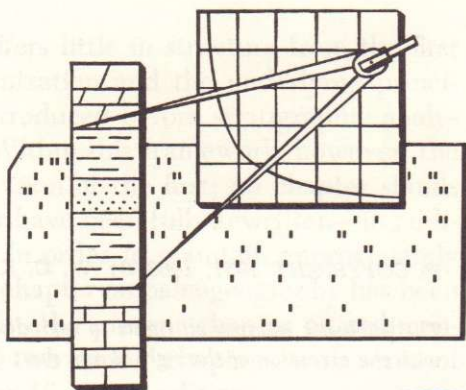


# Stratigraphy and Sedimentation

BY W. C. KRUMBEIN AND L. L. SLOSS

DEPARTMENT OF GEOLOGY, NORTHWESTERN UNIVERSITY

*Second Edition*



W. H. FREEMAN AND COMPANY  
SAN FRANCISCO

# Contents

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	SCOPE OF STRATIGRAPHY AND SEDIMENTATION	1
	ARRANGEMENT OF SUBJECT MATTER	3
	BIBLIOGRAPHIC REFERENCES	6
<b>2</b>	<b>THE STRATIGRAPHIC COLUMN</b>	<b>8</b>
	INTRODUCTION	8
	EVOLUTION OF STRATIGRAPHIC CLASSIFICATION	9
	PRESENT-DAY CLASSIFICATIONS	18
	NEED FOR REVISED CONCEPTS OF CLASSIFICATION	19
	DUAL CLASSIFICATION	22
	THE STRATIGRAPHIC COMMISSION	23
	EARLY CLASSIFICATIONS AND THEIR IMPLICATIONS	24
	MODERN STRATIGRAPHIC CLASSIFICATION	28
	SUPPLEMENTARY READINGS	51
<b>3</b>	<b>STRATIGRAPHIC PROCEDURES</b>	<b>53</b>
	INTRODUCTION	53
	OUTCROP PROCEDURES	53
	SUBSURFACE PROCEDURES	71
	SUPPLEMENTARY READINGS	91
<b>4</b>	<b>PROPERTIES OF SEDIMENTARY ROCKS</b>	<b>93</b>
	INTRODUCTION	93
	TEXTURE OF SEDIMENTARY ROCKS	94
	TEXTURE OF CLASTIC ROCKS	96
	TEXTURAL ELEMENTS OF NONCLASTIC ROCKS	116
	MASS PROPERTIES OF SEDIMENTARY AGGREGATES	118
	COLOR OF SEDIMENTS	123
	SEDIMENTARY STRUCTURES	124
	COMPOSITION OF SEDIMENTARY ROCKS	134
	CHEMICAL COMPOSITION OF SEDIMENTS	141
	SUPPLEMENTARY READINGS	147
		xiii

5. CLASSIFICATION AND DESCRIPTION OF SEDIMENTARY ROCKS	150
INTRODUCTION	150
MODERN CLASSIFICATIONS	150
COMMON SEDIMENTARY FAMILIES	153
DESCRIPTIONS OF SELECTED CLASTIC SEDIMENTARY ROCKS	160
NONCLASTIC SEDIMENTARY ROCKS	176
SUPPLEMENTARY READINGS	188
6. SEDIMENTARY PROCESSES	190
INTRODUCTION	190
ROCK WEATHERING	190
TRANSPORTATION OF SEDIMENTS	196
CLASSIFICATION OF STREAM LOADS	203
SELECTIVE TRANSPORTATION AND ABRASION	207
DEPOSITION OF CLASTIC SEDIMENTS	210
DEPOSITION OF NONCLASTIC SEDIMENTS	218
PROCESS AND RESPONSE IN SEDIMENTARY TRANSPORTATION AND DEPOSITION	231
SUPPLEMENTARY READINGS	232
7. SEDIMENTARY ENVIRONMENTS	234
INTRODUCTION	234
IMPORTANCE OF SEDIMENTARY ENVIRONMENTS IN STRATIGRAPHY	235
SEDIMENTARY PROCESSES AND THEIR PRODUCTS	235
ELEMENTS AND FACTORS OF THE ENVIRONMENT	236
EXAMPLE OF A COMPLEX ENVIRONMENT	240
ENVIRONMENTAL PATTERNS	243
APPLICATIONS OF ENVIRONMENTAL PATTERNS IN STRATIGRAPHY	247
GRADATIONS AMONG SEDIMENTARY ENVIRONMENTS	248
CLASSIFICATION OF SEDIMENTARY ENVIRONMENTS	250
SUMMARY DESCRIPTIONS OF SELECTED SEDIMENTARY ENVIRONMENTS	253
POSTDEPOSITIONAL CHANGES IN SEDIMENTS	262
RECONSTRUCTION OF ANCIENT ENVIRONMENTS	273
SUPPLEMENTARY READINGS	273

8. STRATIGRAPHIC PALEONTOLOGY	275
INTRODUCTION	275
DISTRIBUTION OF ORGANISMS IN SPACE	276
DISTRIBUTION OF ORGANISMS IN TIME	288
CLASSIFICATION OF ORGANISMS	290
SUPPLEMENTARY READINGS	297
9. STRATIGRAPHIC RELATIONSHIPS	299
INTRODUCTION	299
LITHOSOMES	300
SHAPES OF LITHOSOMES	301
VERTICAL RELATIONSHIPS AMONG LITHOSOMES	303
LATERAL RELATIONSHIPS AMONG LITHOSOMES	309
COMBINED LATERAL AND VERTICAL RELATIONSHIPS	310
SEDIMENTARY FACIES	316
OPERATIONAL CONCEPT OF FACIES	326
SUPPLEMENTARY READINGS	330
10. PRINCIPLES OF CORRELATION	332
INTRODUCTION	332
CORRELATION OF LITHOSTRATIGRAPHIC UNITS	332
CORRELATION OF BIOSTRATIGRAPHIC UNITS	351
TIME-STRATIGRAPHY CORRELATION	358
SUPPLEMENTARY READINGS	387
CORRELATION CHARTS	388
11. SEDIMENTARY TECTONICS	390
INTRODUCTION	390
BARRELL'S CONCEPT OF SEDIMENTATION AND SUBSIDENCE	391
SEDIMENTATION AND RATE OF SUBSIDENCE	392
EPEIROGENY AND OROGENY	395
DEVELOPMENT OF GEOSYNCLINAL THEORY	395
SCHUCHERT'S CLASSIFICATION OF GEOSYNCLINES	396
STILLE'S FRAMEWORK FOR CLASSIFICATION OF GEOSYNCLINES	403
KAY'S CLASSIFICATION OF TECTONIC ELEMENTS	404
KAY'S PALEOZOIC FRAMEWORK OF NORTH AMERICA	406
OTHER CLASSIFICATIONS OF TECTONIC ELEMENTS	409
TECTONIC CYCLES AND ASSOCIATED IGNEOUS ACTIVITY	410
PRESENT STATUS OF GEOSYNCLINAL THEORY	414

TECTONIC CLASSIFICATION USED HERE	417
IMPORTANCE OF SEDIMENTARY TECTONICS IN STRATIGRAPHY	421
TECTONICS AND SEDIMENTARY ENVIRONMENTS	422
SUPPLEMENTARY READINGS	431
<b>12. STRATIGRAPHIC MAPS</b>	<b>432</b>
INTRODUCTION	432
ORGANIZATION OF MAP DATA	433
CLASSIFICATION OF STRATIGRAPHIC MAPS	435
STRUCTURE CONTOUR MAPS	437
ISOPACH MAPS	439
PALEO GEOLOGIC MAPS	448
FACIES MAPS	450
BIOFACIES MAPS	492
AUTOMATIC DATA PROCESSING IN STRATIGRAPHIC ANALYSIS	495
CONCLUDING REMARKS	498
SUPPLEMENTARY READINGS	500
<b>13. STRATIGRAPHIC ANALYSIS</b>	<b>501</b>
INTRODUCTION	501
THE CONCEPT OF A STRATIGRAPHIC MODEL	501
LITHOLOGIC ASSOCIATIONS	503
EXAMPLE: THE FRONTIER FORMATION OF WYOMING	513
OBSERVATIONAL LITHOLOGIC ASSOCIATIONS	522
CLASTIC ASSOCIATIONS	526
NONCLASTIC ASSOCIATIONS	567
CONCLUDING REMARKS	589
<b>BIBLIOGRAPHY</b>	<b>591</b>
<b>APPENDIX: THE STRATIGRAPHIC CODE</b>	<b>621</b>
<b>INDEX</b>	<b>637</b>