

# Contents

## *Part I Metamorphic Rocks in the Field*

	<i>page</i>
1 METAMORPHISM AND METAMORPHIC ROCKS	3
Definition	3
The three field categories of metamorphic rocks	4
Aims of study of metamorphic rocks	5
The aims of this book	6
2 FIELD RELATIONS OF METAMORPHIC ROCKS	8
Contact metamorphic rocks	8
Dynamic metamorphic rocks	14
Regional metamorphic rocks	19
3 DESCRIPTION AND IDENTIFICATION OF METAMORPHIC ROCKS IN THE FIELD	29
Primary sedimentary and igneous features	29
Identification of the mineral assemblage	30
Metamorphic fabric	31
Metamorphic rock names	32

## *Part II Metamorphic Rocks Under the Microscope*

A note on the thin section drawings	38
4 THE CHEMICAL AND MINERALOGICAL COMPOSITIONS OF METAMORPHIC ROCKS	39
Introduction	39
The petrological microscope	40
Metamorphic minerals	42
Rock composition	42
Mineral compositions	44
Equilibrium	44
The Phase Rule	47
Composition–assemblage diagrams	51

5	CONTACT METAMORPHIC ROCKS	61
	The Skiddaw contact aureole	61
	The Comrie aureole	68
	The Beinn an Dubhaic aureole, Isle of Skye	74
6	DYNAMIC METAMORPHIC ROCKS	80
	Progressive dynamic metamorphism of granite	80
	The Lochseiten Mylonite, Switzerland	86
	Progressive shock metamorphism at the Nördlinger Ries	
	Crater, Germany	90
	Metamorphism in Moon rocks	93
7	REGIONAL METAMORPHIC ROCKS OF PRECAMBRIAN SHIELD AREAS	97
	Petrology of pyroxene gneisses	99
	Gneissose banding	106
	The origin of migmatites	111
8	REGIONAL METAMORPHIC ROCKS OF PALAEOZOIC OROGENIC BELTS, I	114
	Progressive regional metamorphism of the Furulund	
	Schist	116
	Higher metamorphic grades in schist	124
	Progressive regional metamorphism of the Sulitjelma	
	Amphibolites	128
	Metamorphic grade	135
9	REGIONAL METAMORPHIC ROCKS OF PALAEOZOIC OROGENIC BELTS, II	138
	Pelitic rocks from County Galway	139
	Variation in the conditions of metamorphism in space and time	142
10	REGIONAL METAMORPHIC ROCKS OF CAINOZOIC OROGENIC BELTS	147
	Progressive regional metamorphism of pelitic rocks above the Aar Massif	147
	Blueschists from the western and central Alps	153
	Conditions of formation of blueschists	158
11	METAMORPHIC ROCKS OF THE OCEAN FLOOR	162
	The Troodos basic-ultrabasic complex, Cyprus	163

## 12 METAMORPHIC ROCKS OF THE UPPER MANTLE 170

*Part III Metamorphic Rocks in the Laboratory*

13	THE STUDY OF METAMORPHIC REACTIONS	179
	Direct experiment	180
	Calculations of mineral stability fields	192
	Conclusions	195
	Metamorphic facies	196
14	ISOTOPE GEOLOGY OF METAMORPHIC ROCKS	201
	Unstable isotopes	201
	The potassium–argon method	203
	The rubidium–strontium method	206
	Stable isotopes	209
	Oxygen isotope geothermometry	210
	The origin of water in metamorphic rocks	212
15	ELECTRON-PROBE MICROANALYSIS	216
	The electron-probe microanalyser	216
	The study of metamorphic reactions	217
	The study of coronas	221
16	METAMORPHIC ROCKS AND THE EVOLUTION OF THE EARTH	222
	<i>Appendix</i>	231
	<i>Glossary</i>	232
	<i>References</i>	240
	<i>Index</i>	246