

A HANDBOOK OF DETERMINATIVE METHODS IN CLAY MINERALOGY

Edited by
M.J. WILSON

Head, Department of Mineral Soils
Macaulay Institute for Soil Research
Aberdeen



Blackie
Glasgow and London

Published in the USA by
Chapman and Hall
New York

Contents

1	Clays: their significance, properties, origins and uses	1
P.L. HALL		
1.1	Introduction	1
1.2	Structure and chemistry of clays	2
1.3	Properties of clays	8
1.4	Formation and occurrence of clays	16
1.5	Uses of clays	21
1.6	Introduction to analytical techniques	22
References		23
2	X-ray powder diffraction methods	26
M.J. WILSON		
2.1	Introduction	26
2.2	X-ray diffraction by clay minerals	26
2.3	Sample preparation	36
2.4	X-ray identification of clay minerals	39
2.5	Quantitative analysis	86
References		94
3	Thermal analysis	99
E. PATERSON and R. SWAFFIELD		
3.1	Introduction	99
3.2	Thermoanalytical methods	100
3.3	Instrumentation	103
3.4	Experimental technique	107
3.5	Qualitative analysis	113
3.6	Quantitative analysis	128
References		131
4	Infrared methods	133
J.D. RUSSELL		
4.1	Introduction	133
4.2	Principles	133
4.3	Instrumental requirements	134
4.4	Preparative methods and pretreatments	136
4.5	Identification and characterization of clay minerals and their associated minerals	139
4.6	Interpreting the IR spectra of clay materials	167
4.7	Quantitative analysis	170
References		171
5	Scanning electron microscopy	174
W.J. McHARDY and A.C. BIRNIE		
5.1	Introduction	174
5.2	Instrumentation	174

5.3 Specimen preparation	182
5.4 Microanalysis	190
5.5 Examples	200
References	206
6 Transmission electron microscopy	209
P.H. NADEAU and J.M. TAIT	
6.1 Introduction	209
6.2 Principles	211
6.3 Instrumentation	216
6.4 Specimen preparation	218
6.5 Analytical procedures for clay materials	223
6.6 Electron diffraction of clay particles and aggregates	226
6.7 Micrographs and electron-diffraction patterns of common clay minerals	231
References	246
7 Chemical analysis	248
D.C. BAIN and B.F.L. SMITH	
7.1 Introduction	248
7.2 Sample preparation	249
7.3 Methods of major elemental analysis	252
7.4 Analysis for ferrous iron	254
7.5 Exchange capacity	258
7.6 Determination of a structural formula	262
References	271
8 Characterization of poorly ordered minerals by selective chemical methods	275
B.F.L. SMITH and B.D. MITCHELL	
8.1 Introduction	275
8.2 Principles	275
8.3 Selective chemical methods	277
8.4 Comparison of methods	289
References	292
9 Determinative methods—a brief overview	295
M.J. WILSON	
Index	301