
CONTENTS

PART 1 - MINERALOGICAL ANALYSIS

CHAPTER 1 Water Content and Loss on Ignition

1.1 Introduction	3
1.2 Water Content at 105°C (H₂O⁻)	6
1.2.1 Principle	6
1.2.2 Materials	6
1.2.3 Sample.....	6
1.2.4 Procedure	7
1.2.5 Remarks	7
1.3 Loss on Ignition at 1,000°C (H₂O⁺)	8
1.3.1 Introduction	8
1.3.2 Principle	11
1.3.3 Equipment.....	11
1.3.4 Procedure	11
1.3.5 Calculations	12
1.3.6 Remarks	12
Bibliography	12

CHAPTER 2 Particle Size Analysis

2.1 Introduction	15
2.1.1 Particle Size in Soil Science	15
2.1.2 Principle	17
2.1.3 Law of Sedimentation	18
2.1.4 Conditions for Application of Stokes Law.....	24
2.2 Standard Methods	26
2.2.1 Pretreatment of the Sample	26
2.2.2 Particle Suspension and Dispersion	31
2.2.3 Pipette Method after Robinson-Köhn or Andreasen	35
2.2.4 Density Method with Variable Depth	42
2.2.5 Density Method with Constant Depth.....	47
2.2.6 Particle Size Analysis of Sands Only	48
2.3 Automated Equipment	50
2.3.1 Introduction	50
2.3.2 Method Using Sedimentation by Simple Gravity.....	51
2.3.3 Methods Using Accelerated Sedimentation	53
2.3.4 Methods Using Laser Scattering and Diffraction	54
2.3.5 Methods Using Optical and Electric Properties.....	55
2.3.6 Methods Allowing Direct Observations of the Particles.....	55
2.3.7 Methods Using Conductivity	56
References	56
Bibliography	58
Generality	58

Pre-treatment.....	58
Pipette Method.....	61
Hydrometer Method	62
Instrumental Methods	62
 CHAPTER 3 Fractionation of the Colloidal Systems	
3.1 Introduction	65
3.2 Fractionation by Continuous Centrifugation	66
3.2.1 Principle.....	66
3.2.2 Theory	69
3.2.3 Equipment and reagents	73
3.2.4 Procedure	75
3.3 Pretreatment of the Extracted Phases	79
References.....	81
Bibliography	81
 CHAPTER 4 Mineralogical Characterisations by X-Ray Diffractometry	
4.1 Introduction	83
4.1.1 X-Ray Diffraction and Mineralogy.....	83
4.1.2 Principle.....	86
4.1.3 XRD Instrumentation	87
4.2 Qualitative Diffractometry	90
4.2.1 Overview of Preparation of the Samples	90
4.2.2 Preparation for Powder Diagrams	90
4.2.3 Preparation for Oriented Diagrams.....	94
4.2.4 Pretreatment of Clays	99
4.2.5 Qualitative Diffractometry	113
4.3 Quantitative Mineralogical Analysis	118
4.3.1 Interest	118
4.3.2 Quantitative Mineralogical Analysis by XRD.....	118
4.3.3 Multi-Instrumental Quantitative Mineralogical Analysis.....	124
References.....	126
Bibliography	127
General.....	127
Preparation of Oriented Aggregates on Porous Ceramic Plate	128
Saturation of Clays by Cations	129
Saturation, Solvation, Intercalation Complex, Dissolution	129
Preparation of Iron Oxides.....	130
Quantitative XRD.....	130
 CHAPTER 5 Mineralogical Analysis by Infra-Red Spectrometry	
5.1 Introduction	133
5.1.1 Principle.....	133
5.1.2 IR Instrumentation	135
5.2 IR Spectrometry in Mineralogy.....	138
5.2.1 Equipment and Products	138
5.2.2 Preparation of the Samples	139
5.2.3 Brief Guide to Interpretation of the Spectra.....	146
5.2.4 Quantitative Analysis	152

5.3 Other IR Techniques	156
5.3.1 Near-infrared Spectrometry (NIRS).....	156
5.3.2 Coupling Thermal Measurements and FTIR Spectrometry of Volatile Products	158
5.3.3 Infrared Microscopy	159
5.3.4 Raman Scattering Spectroscopy	159
References	161
Chronobibliography	162

CHAPTER 6 Mineralogical Separation by Selective Dissolution

6.1 Introduction	167
6.1.1 Crystallinity of Clay Minerals.....	167
6.1.2 Instrumental and Chemical Methods	169
6.1.3 Selective Dissolution Methods	172
6.1.4 Reagents and Synthetic Standards	174
6.2 Main Selective Dissolution Methods	180
6.2.1 Acid Oxalate Method Under Darkness (AOD).....	180
6.2.2 Dithionite-Citrate-Bicarbonate Method (DCB)	187
6.2.3 EDTA Method	192
6.2.4 Pyrophosphate Method	196
6.2.5 Extraction in Strongly Alkaline Mediums	201
6.3 Other Methods, Improvements and Choices	206
6.3.1 Differential Sequential Methods	206
6.3.2 Selective Methods for Amorphous Products	210
6.3.3 Brief Overview to the Use of the Differential Methods	214
References	215

CHAPTER 7 Thermal Analysis

7.1 Introduction	221
7.1.1 Definition.....	221
7.1.2 Interest.....	223
7.2 Classical Methods	226
7.2.1 Thermogravimetric Analysis.....	226
7.2.2 Differential Thermal Analysis and Differential Scanning Calorimetry	235
7.3 Multi-component Apparatuses for Thermal Analysis	246
7.3.1 Concepts.....	246
7.3.2 Coupling Thermal Analysis and Evolved Gas Analysis	247
References	249
Chronobibliography	250

CHAPTER 8 Microscopic Analysis

8.1 Introduction	253
8.2 Preparation of the Samples	254
8.2.1 Interest.....	254
8.2.2 Coating and Impregnation, Thin Sections.....	255
8.2.3 Grids and Replicas for Transmission Electron Microscopy	261
8.2.4 Mounting the Samples for Scanning Electron Microscopy	263
8.2.5 Surface Treatment (Shadowing, Flash-carbon, Metallization)	265

8.3 Microscope Studies	267
8.3.1 Optical Microscopy	267
8.3.2 Electron Microscopy, General Information	270
8.3.3 Transmission Electron Microscopy, Micro-diffraction	271
8.3.4 Scanning Electron Microscopy.....	279
8.3.5 Ultimate Micro-analysis by X-Ray Spectrometry	282
References	283
Chronobibliography	284

PART 2 - ORGANIC ANALYSIS

CHAPTER 9 Physical Fractionation of Organic Matter

9.1 Principle and Limitations	289
9.1.1 Forms of Organic Matter in Soil	289
9.1.2 Principle.....	289
9.1.3 Difficulties	291
9.2 Methods	293
9.2.1 Classification	293
9.2.2 Extraction of Plant Roots	293
9.2.3 Dispersion of the Particles	296
9.2.4 Separation by Density.	309
9.2.5 Particle Size Fractionations	314
9.2.6 Precision of the Fractionation Methods	320
9.3 Conclusion and Outlook	321
References	322

CHAPTER 10 Organic and Total C, N (H, O, S) Analysis

10.1 Introduction	327
10.1.1 Soil Organic Matter.....	327
10.1.2 Sampling, Preparation of the Samples, Analytical Significance.....	330
10.2 Wet Methods	333
10.2.1 Total Carbon: General Information	333
10.2.2 Organic Carbon by Wet Oxidation at the Temperature of Reaction	335
10.2.3 Organic Carbon by Wet Oxidation at Controlled Temperature	340
10.2.4 Organic Carbon by Wet Oxidation and Spectrocolorimetry.....	342
10.2.5 Total Nitrogen by Wet Method: Introduction	342
10.2.6 Total Nitrogen by Kjeldahl Method and Titrimetry	344
10.2.7 Kjeldahl N, Titration by Spectrocolorimetry.....	349
10.2.8 Kjeldahl N, Titration by Selective Electrode	351
10.2.9 Mechanization and Automation of the Kjeldahl Method	353
10.2.10 Modified Procedures for NO_3^- , NO_2^- and Fixed N	354
10.3 Dry Methods	355
10.3.1 Total Carbon by Simple Volatilization	355
10.3.2 Simultaneous Instrumental Analysis by Dry Combustion: CHN(OS).....	356
10.3.3 CHNOS by Thermal Analysis	362

10.3.4 C and N Non-Destructive Instrumental Analysis.....	363
10.3.5 Simultaneous Analysis of the Different C and N Isotopes	364
References	365
Bibliography	367

CHAPTER 11 Quantification of Humic Compounds

11.1 Humus in Soils	371
11.1.1 Definitions.....	371
11.1.2 Role in the Soil and Environment	373
11.1.3 Extractions.....	374
11.2 Main Techniques	375
11.2.1 Extraction	375
11.2.2 Quantification of the Extracts.....	379
11.2.3 Precision and Correspondence of the Extraction Methods	383
11.2.4 Purification of Humic Materials	389
11.3 Further Alternatives and Complements Methods	392
11.3.1 Alternative Method of Extraction	392
11.3.2 Fractionation of the Humin Residue.....	392
References	395
Humic Materials	395
Extraction, Titration, Purification and Fractionation of Humic Materials	396

CHAPTER 12 Characterization of Humic Compounds

12.1 Introduction	399
12.1.1 Mechanisms of Formation.....	399
12.1.2 Molecular Structure.....	400
12.2. Classical Techniques	401
12.2.1 Fractionation of Humic Compounds.....	401
12.2.2 Titration of the Main Functional Groups	408
12.2.3 UV–Visible Spectrometry	410
12.2.4 Infra-Red Spectrography.....	413
12.3 Complementary Techniques	415
12.3.1 Improvements in Fractionation Technologies	415
12.3.2 Titration of Functional Groups.....	418
12.3.3 Characterization by Fragmentation	419
12.3.4 Nuclear Magnetic Resonance (NMR)	424
12.3.5 Fluorescence Spectroscopy.....	433
12.3.6 Electron Spin Resonance (ESR) Spectroscopy	435
12.3.7 Measurement of Molecular Weight and Molecular Size	437
12.3.8 Microscopic Observations	440
12.3.9 Other Techniques	441
References	442
Molecular Models.....	442
Fractionation, Determination of Molecular Weights and Molecular Sizes ..	443
Functional Group of Humic Compounds	445
Spectrometric Characterizations	446
UV–Visible, IR, Fluorescence, ESR Spectrometries	446
Nuclear Magnetic Resonance	447

Methods of Characterization by Fragmentation	449
Other Methods (Microscopy, X-ray, Electrochemistry, etc.)	451

CHAPTER 13 Measurement of Non-Humic Molecules

13.1 Introduction	453
13.1.1 Non-Humic Molecules.....	453
13.1.2 Soil Carbohydrates	453
13.1.3 Soil Lipids	456
13.1.4 Pesticides and Pollutants.....	457
13.2 Classical Techniques	458
13.2.1 Acid Hydrolysis of Polysaccharides	458
13.2.2 Purification of Acid Hydrolysates	462
13.2.3 Colorimetric Titration of Sugars	464
13.2.4 Titration of Sugars by Gas Chromatography.....	467
13.2.5 Quantification of Total Lipids.....	472
13.2.6 Quantification of the Water-Soluble Organics	474
13.3 Complementary Techniques	475
13.3.1 Carbohydrates by Gas Chromatography.....	475
13.3.2 Carbohydrates by Liquid Chromatography	475
13.3.3 Fractionation and Study of the Soil Lipid Fraction	478
13.3.4 Measurement of Pesticide Residues and Pollutants	483
References	492
Soil Carbohydrates.....	492
Soil Lipids	494
Aqueous Extract	495
Pesticides and Pollutants.....	495

CHAPTER 14 Organic Forms of Nitrogen, Mineralizable Nitrogen (and Carbon)

14.1 Introduction	497
14.1.1 The Nitrogen Cycle.....	497
14.1.2 Types of Methods	499
14.2 Classical Methods	500
14.2.1 Forms of Organic Nitrogen Released by Acid Hydrolysis	500
14.2.2 Organic Forms of Nitrogen: Simplified Method	509
14.2.3 Urea Titration.....	511
14.2.4 Potentially Available Nitrogen: Biological Methods	513
14.2.5 Potentially Mineralizable Nitrogen: Chemical Methods.....	521
14.2.6 Kinetics of Mineralization.....	526
14.3 Complementary Methods	531
14.3.1 Alternative Procedures for Acid Hydrolysis.....	531
14.3.2 Determination of Amino Acids	532
14.3.3 Determination of Amino Sugars.....	535
14.3.4 Proteins and Glycoproteins (glomalin).....	538
14.3.5 Potentially Mineralizable Nitrogen by EUF	538

References	540
Organic Nitrogen Forms: General Articles	540
Nitrogen Forms by Acid Hydrolysis and Distillation	541
Improvement of Acid Hydrolysis	541
Determination of Amino Acids	541
Determination of Amino Sugars	542
Glomalin	542
Urea Titration	543
Potentially Mineralizable Nitrogen: General Papers	543
Potentially Mineralizable Nitrogen: Biological Methods	544
Potentially Mineralizable Nitrogen: Chemical Methods	545
Potentially Mineralizable Nitrogen by EUF	545
Mineralization Kinetics	546

PART 3 - INORGANIC ANALYSIS – Exchangeable and Total Elements

CHAPTER 15 pH Measurement

15.1 Introduction	551
15.1.1 Soil pH	551
15.1.2 Difficulties	553
15.1.3 Theoretical Aspects	554
15.2 Classical Measurements	556
15.2.1 Methods	556
15.2.2 Colorimetric Method	557
15.2.3 Electrometric Method	560
15.2.4 Electrometric Checking and Calibration	564
15.2.5 Measurement on Aqueous Soil Suspensions	565
15.2.6 Determination of the pH-K and pH-Ca	567
15.2.7 Measurement on Saturated Pastes	567
15.2.8 Measurement on the Saturation Extract	568
15.2.9 Measurement of the pH-NaF	569
15.3 In Situ Measurements	570
15.3.1 Equipment	570
15.3.2 Installation in the Field	570
15.3.3 Measurement on Soil Monoliths	572
References	574
Bibliography	575
Appendix	576
Appendix 1: Table of Electrode Potentials	576
Appendix 2: Constants of Dissociation of Certain Equilibria	577
Appendix 3: Buffer Solutions	577
Appendix 4: Coloured Indicators	579

CHAPTER 16 Redox Potential

16.1 Definitions and Principle	581
16.2 Equipment and Reagents	583
16.2.1 Electrodes	583
16.2.2 Salt Bridge for Connection	584
16.2.3 System of Measurement	584
16.2.4 Calibration Solutions	585

16.3 Procedure	585
16.3.1 Pretreatment of the Electrode	585
16.3.2 Measurement on Soil Sample	586
16.3.3 Measurement on Soil Monolith	586
16.3.4 In Situ Measurements.....	587
16.3.5 Measurement of Oxygen Diffusion Rate	588
16.3.6 Colorimetric Test of Eh	589
References	589
Bibliography	590

CHAPTER 17 Carbonates

17.1 Introduction	593
17.2 Measurement of Total Carbonates	595
17.2.1 Introduction	595
17.2.2 Volumetric Measurement by Calcimetry	596
17.2.3 Acidimetry.....	599
17.3 Titration of Active Carbonate	601
17.3.1 Principle.....	601
17.3.2 Implementation	601
17.3.3 Index of Chlorosis Potential.....	603
References	604

CHAPTER 18 Soluble Salts

18.1 Introduction	605
18.2 Extraction	606
18.2.1 Soil/solution Ratio	606
18.2.2 Extraction of Saturated Paste	607
18.2.3 Diluted Extracts	608
18.2.4 In Situ Sampling of the Soil Water	609
18.2.5 Extracts with Hot Water	610
18.3 Measurement and Titration	610
18.3.1 Electrical Conductivity of Extracts.....	610
18.3.2 In Situ Conductivity.....	613
18.3.3 Total Dissolved Solid Material	614
18.3.4 Soluble Cations	615
18.3.5 Extractable Carbonate and Bicarbonate (Alkalinity)	616
18.3.6 Extractable Chloride	618
18.3.7 Extractable Sulphate, Nitrate and Phosphate	620
18.3.7 Extractable Boron	620
18.3.8 Titration of Extractable Anions by Ionic Chromatography.....	622
18.3.9 Expression of the Results	625
References	626

CHAPTER 19 Exchange Complex

19.1 Introduction	629
19.2 Origin of Charges	630
19.2.1 Ionic Exchange	630

19.2.2 Exchange Complex	631
19.2.3 Theory	633
References	636
Chronobibliography	637

CHAPTER 20 Isoelectric and Zero Charge Points

20.1 Introduction	645
20.1.1 Charges of Colloids	645
20.1.2 Definitions	647
20.1.3 Conditions for the Measurement of Charge	649
20.2 Main Methods	651
20.2.1 Measurement of pH ₀ (PZSE), Long Equilibrium Time	651
20.2.2 Point of Zero Salt Effect (PZSE), Short Equilibrium Time	652
References	655

CHAPTER 21 Permanent and Variable Charges

21.1 Introduction	657
21.2 Main Methods	661
21.2.1 Measurement of Variable Charges	661
21.2.2 Determination of Permanent Charges	662
References	664
Bibliography	665

CHAPTER 22 Exchangeable Cations

22.1 Introduction	667
22.1.1 Exchangeable Cations of Soil	667
22.1.2 Extracting Reagents	668
22.1.3 Equipment	669
22.2 Ammonium Acetate Method at pH 7	671
22.2.1 Principle	671
22.2.2 Procedure	671
22.3 Automated Continuous Extraction	674
References	674
Bibliography	676

CHAPTER 23 Exchangeable Acidity

23.1 Introduction	677
23.1.1 Origin of Acidity	677
23.1.2 Aims of the Analysis	678
23.2 Method	680
23.2.1 Principle	680
23.2.2 Reagents	680
23.2.3 Procedure	681
23.3 Other Methods	683
References	684
Chronobibliography	685

CHAPTER 24 Lime Requirement

24.1 Introduction	687
24.1.1 Correction of Soil Acidity	687
24.1.2 Calculation of Correction	688
24.2 SMP Buffer Method	690
24.2.1 Principle	690
24.2.2 Reagents	691
24.2.3 Procedure	691
24.2.4 Remarks	692
References	693
Chronobibliography	693

CHAPTER 25 Exchange Selectivity, Cation Exchange Isotherm

25.1 Introduction	697
25.2 Determination of the Exchange Isotherm	702
25.2.1 Principle	702
25.2.2 Reagents	702
25.2.3 Procedure	703
25.2.4 Remarks	704
References	705
Chronobibliography	706

CHAPTER 26 Cation Exchange Capacity

26.1 Introduction	709
26.1.1 Theoretical Aspects	709
26.1.2 Variables that Influence the Determination of CEC	711
26.2 Determination of Effective CEC by Summation (ECEC)	718
26.2.1 Principle	718
26.2.2 Alternative Methods	718
26.3 CEC Measurement at Soil pH in Not-Buffered Medium	719
26.3.1 Principle	719
26.3.2 Methods Using Not-Buffered Metallic Salts	719
26.3.3 Procedure Using Not-Buffered Organo Metallic Cations	722
26.3.4 Not-Buffered Methods Using Organic Cations	728
26.4 CEC Measurement in Buffered Medium	730
26.4.1 Buffered Methods — General Information	730
26.4.2 Ammonium Acetate Method at pH 7.0	732
26.4.3 Buffered Methods at pH 8.0–8.6	738
26.4.4 Buffered Methods at Different pH	743
References	745
Bibliography	750
CEC General Theory	750
Barium Method at soil pH	751
Buffered Method at pH 7.0	751
Cobaltihexamine CEC	752
Silver-Thiourea	753
CEC with Organic Cations (Coloured Reagents)	753
Buffered Methods at pH 8.0–8.6	753
Barium Chloride-Triethanolamine at pH 8.1	753

CHAPTER 27 Anion Exchange Capacity

27.1 Theory	755
27.2 Measurement	758
27.2.1 Principle	758
27.2.2 Method	760
27.3 Simultaneous Measurement of AEC, EC, CEC and net CEC	760
27.3.1 Aim	760
27.3.2 Description	761
References	763

CHAPTER 28 Inorganic Forms of Nitrogen

28.1 Introduction	767
28.1.1 Ammonium, Nitrate and Nitrite	767
28.1.3 Sampling Problems	768
28.1.4 Analytical Problems	768
28.2 Usual Methods	769
28.2.1 Extraction of Exchangeable Forms	769
28.2.2 Separation by Micro-Diffusion	770
28.2.3 Colorimetric Titration of Ammonium	773
28.2.4 Colorimetric Titration of Nitrites	775
28.2.5 Colorimetric Titration of Nitrates	778
28.2.6 Extracted Organic Nitrogen	779
28.3 Other Methods	780
28.3.1 Nitrate and Nitrite by Photometric UV Absorption	780
28.3.2 Ammonium Titration Using a Selective Electrode	782
28.3.3 Measurement of Nitrates with an Ion-Selective Electrode	785
28.3.4 In situ Measurement	788
28.3.5 Non-Exchangeable Ammonium	790
References	791
Bibliography	792

CHAPTER 29 Phosphorus

29.1 Introduction	793
29.2 Total Soil Phosphorus	794
29.2.1 Introduction	794
29.2.2 Wet Mineralization for Total Analyses	795
29.2.3 Dry Mineralization	798
29.3 Fractionation of Different Forms of Phosphorus	799
29.3.1 Introduction	799
29.3.2 Sequential Methods	800
29.3.3 Selective Extractions – Availability Indices	804
29.3.4 Isotopic Dilution Methods	813
29.3.5 Determination of Organic Phosphorus	814
29.4 Retention of Phosphorus	818
29.4.1 Introduction	818
29.4.2 Determination of P Retention	819

29.5 Titration of P in the Extracts	821
29.5.1 Introduction	821
29.5.2 Titration of <i>Ortho</i> -phosphoric P by Spectrocolorimetry	823
29.5.3 P Titration by Atomic Spectrometry	828
29.5.4 Titration of Different Forms of P by ^{31}P NMR	828
29.5.5 Separation of P Compounds by Liquid Chromatography	829
29.6 Direct Speciation of P in situ, or on Extracted Particles	830
References	830
Chronobibliography	833

CHAPTER 30 Sulphur

30.1 Introduction	835
30.1.1 Sulphur Compounds	835
30.1.2 Mineralogical Studies	838
30.2 Total Sulphur and Sulphur Compounds	839
30.2.1 Characteristics of Fluvio-marine Soils	839
30.2.2 Soil Sampling and Sample Preparation	840
30.2.3 Testing for Soluble Sulphur Forms	841
30.2.4 Titration of Total Sulphur	842
30.2.5 Total S Solubilisation by Alkaline Oxidizing Fusion	843
30.2.6 Total Solubilisation by Sodium Hypobromite in Alkaline Medium	844
30.2.7 S titration with Methylene Blue Colorimetry	845
30.2.8 Sulphate Titration by Colorimetry with Methyl Thymol Blue	850
30.2.9 Total Sulphur by Automated Dry CHN(OS) Ultimate Analysis	853
30.2.10 Titration of Total SO_4^{2-} -S by Ionic Chromatography	855
30.2.11 Total S Titration by Plasma Emission Spectrometry	857
30.2.12 Titration by X-ray Fluorescence	857
30.2.13 Titration by Atomic Absorption Spectrometry	857
30.2.14 Analytical Fractionation of Sulphur Compounds	858
30.2.15 Titration of Organic S bound to C	859
30.2.16 Titration of Organic S not bound to C	861
30.2.17 Extraction and Titration of Soluble Sulphides	863
30.2.18 Titration of Sulphur in Pyrites	865
30.2.19 Titration of Elementary Sulphur	867
30.2.20 Titration of Water Soluble Sulphates	869
30.2.21 Titration of $\text{Na}_3\text{-EDTA}$ Extractable Sulphates	871
30.2.22 Titration of Jarosite	873
30.2.23 Sequential Analysis of S Forms	876
30.3 Sulphur of Gypseous Soils	878
30.3.1 Gypseous Soils	878
30.3.2 Preliminary Tests	879
30.3.3 Extraction and Titration from Multiple Extracts	881
30.3.4 Gypsum Determination by Acetone Precipitation	882
30.4 Sulphur and Gypsum Requirement of Soil	883
30.4.1 Introduction	883
30.4.2 Plant Sulphur Requirement	884
30.4.3 Gypsum Requirement	886
References	888
Chronobibliography	890

CHAPTER 31 Analysis of Extractable and Total Elements

31.1 Elements of Soils	895
31.1.1 Major Elements	895
31.1.2 Trace Elements and Pollutants	897
31.1.3 Biogenic and Toxic Elements	899
31.1.4 Analysis of Total Elements	900
31.1.5 Extractable Elements	901
31.2 Methods using Solubilization	901
31.2.1 Total Solubilization Methods	901
31.2.2 Mean Reagents for Complete Dissolutions	903
31.2.3 Acid Attack in Open Vessel	906
31.2.4 Acid Attack in Closed Vessel	911
31.2.5 Microwave Mineralization	913
31.2.6 Alkaline Fusion	915
31.2.7 Selective Extractions	920
31.2.8 Measurement Methods	925
31.2.9 Spectrocolorimetric Analysis	927
31.2.10 Analysis by Flame Atomic Emission Spectrometry	931
31.2.11 Analysis by Flame Atomic Absorption Spectrometry	932
31.2.12 Analysis of Trace Elements by Hydride and Cold Vapour AAS	937
31.2.13 Analysis of Trace Elements by Electrothermal AAS	940
31.2.14 Analysis by Inductively Coupled Plasma-AES	941
31.2.15 Analysis by Inductively Coupled Plasma-Mass Spectrometry	946
31.3 Analysis on Solid Medium	952
31.3.1 Method	952
31.3.2 X-ray Fluorescence Analysis	954
31.3.3 Neutron Activation Analysis	962
References	969
 INDEX	 975
 PERIODIC TABLE OF THE ELEMENTS	 993

Handbook of Soil Analysis

Mineralogical, Organic and Inorganic Methods

Pansu, M.; Gautheyrou, J.

2006, XIX, 993 p. 183 illus., Hardcover

ISBN: 978-3-540-31210-9