

Contents

1 Introduction – definition of the environmental mineralogy	5
1.1 Scope of this book	6
2 Mineral characterization	8
2.1 Structural characterization.....	8
2.2 Mineral surface characterization.....	11
2.2.1 Morphological characterization of the surface	11
2.2.2 Chemical characterization of surfaces	14
3 Minerals in the environment.....	16
3.1 Nanoparticles and nanominerals	16
3.1.1 Nanoparticles occurrence and distribution	18
3.1.2 Nanoparticle Surface Area, Stability, and Reactivity.....	20
3.1.3 Potential environmental effects of engineered and natural nanoparticles.....	21
3.2 Mineral contaminants in the geosphere	22
3.2.1 Acid mine drainage and acid rock drainage	22
3.2.1.1 Chemistry and mineralogy of the AMD/ARD processes.....	24
3.2.1.2 Prevention and mitigation of AMD.....	29
3.3 Minerals in the atmosphere	30
3.3.1 Size distributions of atmospheric particles	30
3.3.2 Natural minerals in the atmospheric aerosol	32
3.3.2.1 Silica	32
3.3.2.2 Mineral fibres	33
3.3.3 Particles from traditional coal combustion.....	37
3.3.3.1 Brown coal characterization	38
3.3.3.2 Fly ashes from conventional pulverized coal combustion	40
3.3.3.3 The mode of occurrence of trace elements	44
3.3.4 Fluidised bed combustion ashes	47
3.3.4.1 Mineralogy of FBC ashes	47
3.3.4.2 Forms of occurrence of trace elements in FBC ashes.....	49
3.3.5 Comparison of traditional and FBC fly ashes.....	50
3.3.6 Utilization of fly ash	52
3.3.7 Atmospheric Nanoparticles.....	54
4 Minerals and contamination / waste management.....	56
4.1 Clay minerals	56
4.2 Zeolites.....	63
4.3 Oxides and hydroxides of Fe, Al, Mn.....	67
4.4 Ti oxides.....	71
4.5 Phosphates	72
4.6 Ettringite	76
5 Matrices for nuclear waste.....	77
References and further reading.....	79