

# Contents

<i>Preface</i>	<i>page xi</i>
<i>Acknowledgements</i>	<i>xii</i>

---

<b>Part I</b>	<b>The building blocks of the soil</b>	<b>1</b>
<b>1</b>	<b>Introduction</b>	<b>3</b>
	Pioneers of soil science, soil survey and soil geography	4
	Things we hold self-evident...	6
	The framework for this book	7
<b>2</b>	<b>Basic concepts: soil morphology</b>	<b>9</b>
	Texture	9
	Color	14
	Pores, voids and bulk density	17
	Structure	18
	Consistence	20
	Presentation of soil profile data	22
	Soil micromorphology	22
<b>3</b>	<b>Basic concepts: soil horizonation... the alphabet of soils</b>	<b>32</b>
	Regolith, residuum and the weathering profile	32
	The soil profile, pedon, polypedon and map unit	33
	Soil horizons and the solum	36
	Types of soil horizons	36
	Buried soils	52
<b>4</b>	<b>Basic concepts: soil mineralogy</b>	<b>54</b>
	Bonding and crystal structures	54
	Oxides	55
	Chlorides, carbonates, sulfates, sulfides, and phosphates	60
	Silicates	61
	Identification of phyllosilicates by X-ray diffraction	73
	Identification of iron and aluminum oxides	80
<b>5</b>	<b>Basic concepts: soil physics</b>	<b>82</b>
	Soil water retention and energy	82
	Soil water movement	85
	Soil temperature	87
	Soil gas composition and transport	91

<b>6</b>	<b>Basic concepts: soil organisms</b>	93
	Primary producers	93
	Soil fauna	96
<b>7</b>	<b>Soil classification, mapping and maps</b>	106
	Soil geography, mapping and classification	106
	The system of Soil Taxonomy	107
	The Canadian system of soil classification	146
	Soil mapping and soil maps	146
	Soil landscape analysis	158
<hr/> <b>Part II</b> Soil genesis: from parent material to soil		165
<b>8</b>	<b>Soil parent materials</b>	167
	Effects of parent material on soils	167
	The mutability of time <sub>zero</sub>	169
	A classification of parent materials	170
	Lithologic discontinuities in soil parent materials	215
<b>9</b>	<b>Weathering</b>	226
	Physical weathering	227
	Chemical and biotic weathering	231
	Products of weathering	236
	Controls on physical and chemical weathering	236
	Assessing weathering intensity	238
<b>10</b>	<b>Pedoturbation</b>	239
	Classifying pedoturbation: proisotropic vs. proanisotropic	239
	Expressions of pedoturbation	244
	Forms of pedoturbation	245
	Lesser-studied forms of pedoturbation	293
<b>11</b>	<b>Models and concepts of soil formation</b>	295
	Dokuchaev and Jenny: functional-factorial models	296
	Simonson's process-systems model	320
	Runge's energy model	323
	Johnson's soil thickness model	324
	Johnson and Watson-Stegner's soil evolution model	325
	Phillips' deterministic chaos and uncertainty concepts	339
	Other models	342
	The geologic timescale and paleoclimates as applied to soils	342
<b>12</b>	<b>Soil genesis and profile differentiation</b>	347
	Eluviation-illuviation	353
	Process bundles	354

Surface additions and losses	456
Mass balance analysis, strain and self-weight collapse	460
<b>Part III   Soil geomorphology</b>	463
<b>13 Soil geomorphology and hydrology</b>	465
The geomorphic surface	466
Surface morphometry	468
The catena concept	469
Soil geomorphology case studies, models and paradigms	514
<b>14 Soil development and surface exposure dating</b>	547
Stratigraphic terminology, principles and geomorphic surfaces	547
Numerical dating	549
Relative dating	550
Principles of surface exposure dating (SED)	554
SED methods based on geomorphology, geology and biology	555
SED methods based on soil development	567
Chronosequences	587
Numerical dating techniques applicable to soils	596
<b>15 Soils, paleosols and paleoenvironmental reconstruction</b>	619
Paleosols and paleopedology	620
Environmental pedo-signatures	632
<b>16 Conclusions and Perspectives</b>	653
<i>References</i>	657
<i>Glossary</i>	741
<i>Index</i>	791