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The Chemistry of Soils. Third Edition. By Garrison Sposito. Oxford University Press, 2016. Hardback, Pp. 272. Price GBP 59.00, EUR 216.00. ISBN 9780190630881

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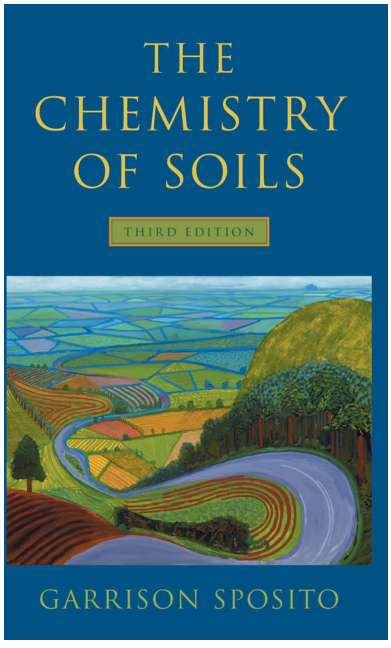

The completely revised third edition of this book by Garrison Sposito reflects the latest insights in the field and is a welcome update for those who want to have a fundamental insight into the processes in soils, insight which is needed to safeguard the crucial role of soils for life on earth.

The first four chapters describe the components of soil, namely soil minerals, humus, gas and the soil solution.

Chapter 1, *The Composition of Soils*, gives an introduction to the components of soil and reader's attention is drawn to the natural capital of the soil. According to the author, 'the critical assets derive primarily from three fundamental soil properties: texture, mineralogy and humus'.

Chapter 2, *Soil Minerals*, describes nicely how soil minerals form, the structure of the minerals and how this determines their stability against weathering. Furthermore, the retention of ions by clay and metal oxide minerals is discussed.

Chapter 3, *Soil Humus*, has been completely rewritten from previous editions and treats soil humus according to the new view on organic matter, of which the author has been one of the pioneers. Humification of plant and animal litter is described as an analogue to the weathering of minerals, and humus is seen as complex mixtures of identifiable molecules that can be attributed to their litter sources rather than considering the operationally defined fractions, including humin, humic and fulvic acids, to be unique new macromolecular compounds according to the classical view which is totally discarded here.

Chapter 4, *The Soil Solution*, starts with a discussion of the methods used for sampling the soil solution. This is followed by descriptions of complex formation in the soil solution and the calculation method of chemical speciation. In this chapter, I, however, missed an explicit discussion of metal complexes with organic ligands which play a very important role in metal speciation.

In the following chapters, the important chemical processes in soil, *viz.* mineral weathering, oxidation–reduction reactions, adsorption and ion-exchange, are discussed, together with a chapter on soil-particle surface charge and a chapter on soil colloids. These subjects are discussed thoroughly from a physical chemical perspective and give clear insights into the processes.

Chapter 5, *Mineral Weathering*, first describes the mechanism of mineral weathering followed by mineral-weathering sequences. The chapter concludes with a section on phosphate transformations in calcareous soils and its implications on phosphate availability.

Chapter 6, *Oxidation–Reduction Reactions*, describes the principles of redox reactions on the basis of the most relevant redox processes occurring in flooded soils and their sequence from oxidized to more and more reduced systems, which is known as the redox ladder. Finally, the construction of pE–pH diagrams is explained.

In Chapter 7, *Soil Particle Surface Charge*, the concepts of structural charge due to the structural defects in minerals, and surface charge due to the adsorption of ions at the soil particle–water interface are discussed, together with various definitions for the 'point of zero charge', which is the pH at which the surface charge due to adsorption or desorption is zero.

Chapter 8, *Soil Adsorption Phenomena*, deals mainly with the adsorption of both cationic and anionic species to soils. Adsorption of organic molecules is also discussed.

The various possible forms of adsorption isotherms are nicely explained with respect to the mechanisms and properties of the adsorbents and adsorbates. Modelling of the adsorption processes is confined to models fitting adsorption curves, like the Langmuir and the van Bemmelen–Freundlich equations, without giving an outlook to mechanistically based models such as surface complexation models. The chapter ends with an interesting paragraph on surface redox processes and their importance for the reductive dissolution of Fe^{III}- and Mn^{IV}-bearing minerals.

Chapter 9, *Exchangeable Ions*, first defines the cation-exchange capacity of soils and discusses nonpreference and selective ion exchange. Furthermore, this chapter describes the biotic ligand model, a chemical approach for describing the toxicity of trace metals to soil biota. The chapter concludes with a paragraph on the advanced sorption model for ion binding to humus, *i.e.* the NICA–Donnan model.

Chapter 10, *Soil Colloids*, describes colloids present in soils, their stability in suspension and the kinetics of flocculation. The chapter is rather theoretical, and practical implications for erosion and transport are only touched on. I found this chapter rather detailed in comparison with the other subjects in the book.

The last two chapters discuss two major soil-degrading processes, namely acidification and soil salinization, which are a threat to the ecosystem functions of soils.

Chapter 11, *Soil Acidity*, describes the mechanisms of soil acidification, the capacity of soil to neutralize acidity and buffer the pH, and the problem of toxic aluminium, which becomes increasingly soluble with decreasing pH.

In Chapter 12, *Soil Salinity*, the principles of salinity are discussed. High salinity is a problem for the growth of crops and for the soil structure, and hence the permeability of soil. Special attention is given to boron, which may have toxic concentrations in arid-zone soils, and to irrigation water quality.

The book is suitable for teaching soil chemistry to students with a basic knowledge of physical chemistry and soil science. Each chapter ends with problems both as exercises and to stimulate further thinking on the subject. The text is clear, but is, however, rather densely written. The book is certainly also of interest for researchers already familiar with soil chemistry, as it may provide a new and interesting view of the subject.