Soil constituents

The Chemistry of Soil Constituents. Edited by D. J. Greenland and M. H. B. Hayes. Pp. 469. (Wiley: London and Chichester, UK, 1978.) £26.

THIS enterprise is most welcome, as apart from the two encyclopaedic volumes (*Soil Components*, Springer: Berlin, 1975) edited by J. E. Gieseking, no advanced textbook of soil chemistry has been published for many years. The editors consider their subject falls naturally into two parts, the present volume *The Chemistry of Soil Constituents* covering static aspects, and a volume to be published shortly *The Chemistry of Soil Processes* covering dynamic aspects.

The introductory chapter (28 pages) by the editors places the topics of later chapters in the context of soil science as a whole. Chapter 2 (150 pages) entitled 'The Structures and Chemistry of Soil Clay Minerals' by the Rothamsted team of G. Brown, A. C. D. Newman, J. H. Rayner and A. H. Weir is a book in itself. Although clear accounts of the classical aluminosilicate clays already exist, for example, by Grim, this chapter treats the inorganic oxides and fibrous magnesium silicates more fully. Recent developments in two directions are particularly well described. Many soil clays consist of interstratified minerals in which different types of unit—kaolinite, smectite, and so on—alternate in a regular or irregular manner, and the account of the unravelling of these structures is very valuable. Soils developed from weathered volcanic ash commonly have such unusual features as a bulk density less than 0.85 g cm^{-3}. They contain the thread-like mineral imogolite and amorphous allophane; and the confused literature on these substances has been clarified. The excellent electron micrographs are a feature of this chapter. Much trouble has been taken to show complicated structures in two-dimensional diagrams, but this remains a problem, and I would like to have seen some stereopairs.

Chapter 3 (122 pages) entitled 'The Chemistry of Soil Organic Colloids' by M. H. B. Hayes and R. S. Swift deals with the chemical and physical properties of humified substances—not the materials from which they are derived, so lignin and polyphenols, for example, receive little mention. Those who have already decided that humus chemistry is a complex topic best left to its specialist devotees are unlikely to change their opinion on reading this chapter. The authors rightly emphasise experimental methods of fractionating the humus moieties, and discuss how reliably they have been identified. The size, shape and weight of humus polymers are clearly described. Humic substances are distinguished in this account from "compounds belonging to recognisable classes, such as polysaccharides, polypeptides and altered lignins". The polysaccharides are thoroughly treated in a separate section, but the organic forms of nitrogen, sulphur and phosphorus receive no attention.

The rest of the book concentrates on surface phenomena. C. J. B. Mott and D. J. Greenland (chapter 4, 29 pages) describe the structure of the mineral surfaces and the determination of their area. G. W. Arnold (chapter 5, 44 pages) deals with surface charges and V. C. Farmer (chapter 6, 38 pages) with the structure of water on the surfaces. Together these chapters contain by far the most coherent account of soil surfaces yet assembled. Arnold's discussion of the point of zero charge in soils is particularly illuminating. I wish he had treated the effect of Ca^{2+} ions in ordering adjacent clay tactoids more thoroughly. The electrical double layer theory he so well describes does not account for this effect, on which the structure of most soils, and thus agriculture, depends. This latter section of the book cries out for a discussion of the affinity of the various surfaces for cations and anions, and a comprehensive account of cation and ligand exchange. These matters are to be treated in the second volume.

The writing throughout is clear and concise, and there are few serious errors. The index is good and the general standard of production high—so too is the price, though the scientific value per page is well above average. The book is unlikely to be replaced for at least a decade, so I rate it a good though expensive buy for all advanced students of soil chemistry.

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Introductory oceanography

Introductory Dynamic Oceanography. By S. Pond and G. L. Pickard. Pp. 240. (Pergamon : Oxford, 1978.) Hardback £15; paperback £5.

ALTHOUGH a number of books published recently have given a general introduction to physical oceanography, a need has remained for a textbook providing a sound dynamical treatment, starting from first principles. This gap has been filled by Pond and Pickard's new book, which has evolved from a course of lectures given for a number of years at the University of British Columbia to students drawn from several disciplines. Its origin is reflected in the detailed explanations of many concepts which are frequently taken for granted in textbooks.

The book starts with a description of the properties of sea water and the basic physical laws relating to movements of water in the sea. There follows a clear explanation of the equations of continuity and motion, including a good discussion of the Coriolis effects. The influence of non-linear terms is given a separate chapter, which includes a discussion of the scales of terms in the equations of motion and introduces the role of the Rossby, Ekman and Richardson numbers in this context.

The chapter devoted to frictionless geostrophic flow gives a thorough treatment of the basic dynamics and its practical application to oceanographic data. The longest chapter in the book is that on currents with friction, which starts with the classical Ekman spiral theory and leads on to solutions applicable to the large scale wind-driven circulation of the oceans. The treatment of the boundary layer approach given in the last part of the chapter is more advanced than the rest but is well done.

A feature of particular interest is the inclusion of a chapter on numerical models. Without going into computational details, it gives a good account of the principles of modelling the ocean circulation and the treatment of boundary conditions, followed by a description and critical discussion of several individual models. The chapters on waves and tides are less detailed than the rest of the book and are largely qualitative. There are, however, other textbooks which deal with these topics.

The authors have succeeded in producing a textbook which will not only give the reader a basic understanding of physical oceanography but also bring him to the stage where he can appreciate advances being made at the frontiers of the subject.

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