of enhancing the efficiency of water use. The influence of soil fertility on water use and the interesting effect of water on the availability and uptake of soil nutrients and gases are adequately covered. Recent observations concerning the effect of carbon dioxide enrichment on the use of water are included in a chapter by Heichel.

A wide range of irrigation options are available where the investment can be justified and where a reliable supply of water of good quality is available. The strengths and limitations of a number of irrigation systems, approaches to determining the rate and timing of the application, the utility of computers and simulation models, and the allocation of water among crops varying in water requirement are discussed in three chapters. The few omissions in the book, among them discussion of the effect of use of water on seed quality, are largely a reflection of our lack of knowledge.

Each chapter is a competent evaluation of our current understanding. The only unqualified criticism that should be mentioned is that some new knowledge acquired during the four years between working session and publication is lacking. For the most part, however, principles are stressed in such a way that this work will serve well for some time the needs of scientists asking fundamental questions concerning how best to ensure and enhance efficient water utilization by crops. A unifying thread is the need felt by each author for the formation of research teams consisting of not only breeders and physiologists but also soil scientists, engineers, pathologists, entomologists, and others if significant progress on this subject is to continue.

R. P. PATTERSON
Department of Crop Science, North Carolina State University, Raleigh 27650-7620

The Magnetism of Rocks

Rock and Mineral Magnetism. W. O'REILLY. Blackie, Glasgow, 1984 (U.S. distributor, Chapman and Hall, New York). xii, 220 pp., illus. $39.95.

The appearance of a new book on rock magnetism is something of an event, and a book reviewing both magnetic mineralogy and physical processes in the space of 220 pages is a rarity indeed. O'Reilly has written a book with comparatively broad appeal. Physicists looking for the latest information on cation distributions and intrinsic magnetic properties of the iron-titanium oxides will find it in abundance in chapters 2, 7, and 8. Geologists and particularly paleomagnetists will find applications to subjects such as cooling histories, paleofield intensities, and demagnetizing techniques in chapter 9 and, with a little digging, elsewhere in the book.

Another strength of the book is its completeness. Nowhere else between hard covers will one find gathered definitive treatments of (microscopic) crystalline anisotropy (chapter 3) and (macroscopic) shape anisotropy (chapter 4), step-by-step tracing of domain-wall motions and thermally activated reversals, complete with picture-story diagrams (chapters 4, 5, and 6), an account of the effect of thermal fluctuations on coercive force, including the Jaep theory (chapters 6 and 9), and a virtual encyclopedia of experimental data for titanomagnetites and other magnetic minerals (chapters 7 and 8).

Inevitably this book will be compared with its distinguished predecessor, Nagata's *Rock Magnetism* (1953; second edition 1961). Nagata's book still makes good reading today. Its usefulness to succeeding generations of rock magnetists is linked to its style—a sort of plumber's handbook, as it was once described as to me. Every aspect of the subject is covered and neatly shelved for easy reference. O'Reilly's book is nearly as complete, a signal achievement for a one-man effort (Nagata had the assistance of a team of gifted students), especially considering the explosion of knowledge in the intervening two decades. On the other hand, information is not as easily retrieved as it is in Nagata's book. Many more diagrams and tables could have been used to advantage in the experimental chapters to lighten the reader's burden in sifting through long, long paragraphs that merely catalog data.

Part of the problem is the nontraditional arrangement of topics. Theoretical models of thermal, detrital, chemical, and other remanences are developed in chapters 4, 5, and 6 in isolation from the experimental evidence pro and con, which follows in chapters 7 and 8. The bridge between theory and experiment is never satisfactorily established—as perhaps it is not in many rock magnetists' minds. The long gap between chapter 2, which deals with the structure and chemistry of magnetic minerals, and chapers 7 and 8, which review the magnetic properties of minerals, likewise disrupts the flow of the book.

Compared with Stacey and Banerjee's 1974 textbook *Physical Principles of Rock Magnetism*, which fairly bristles with equations, this book gives the illusion of being non-mathematical. The essential equations are there, in fact, but are concealed in the middle of paragraphs, a space-saving device that makes them next to impossible to relocate when needed. There is a decided difference in philosophy between the two books. Stacey and Banerjee's incisive account of the latest theoretical models of the time backed a number of personal favorites (some now superseded) to the exclusion of some traditional mainstays, notably Néel's theories of thermoremanence.

O'Reilly has aimed instead for balance and perspective. His overviews treat all theories fairly, though he has an annoying tendency not to name the originators of the theories that have been seminal to rock magnetism. One shouldn't have to wait until p. 87 to learn that the model developed on pp. 69–73 is that of Stoner and Wohlfarth, and Néel's name should be placed squarely at the head of his thermal fluctuation theory, which is the bedrock of rock magnetism. (In fact, not one of Néel's three greatest papers is anywhere referenced in the book, a great loss to the coming generation of students.) In the effort to give equal time to all models, some of the excitement of this evolving subject has been lost (for example the controversy about the origin of pseudo–single-domain effects is glossed over), but the author's information is nonetheless very much up to date.

O'Reilly writes deftly and amusingly. The book flows along nicely until both author and reader begin to bog down in the data catalogs of chapters 7 and 8. The final chapter, on applications, is easy reading. The novice in rock magnetism, to whom the book is principally directed according to the preface, will require many sittings to digest its contents, but seasoned rock and paleomagnetists will find the book indispensable as a teaching text and handbook.

D. J. DUNLOP
Department of Physics, University of Toronto, Toronto, Ontario M5S 1A7, Canada

Books Received

Adaptive Control of Ill-Defined Systems. Oliver G. Selfridge, Edwina L. Rissland, and Michael A. Arbib, Eds. Plenum, New York, 1984. x, 349 pp., illus. $47.50. NATO Conference Series II, vol. 16. From an institute, Moretonhampstead, Devon, England, June 1981.

Advances in Chromatography. Vol. 23. J. Calvin Giddings *et al.*, Eds. Dekker, New York, 1984. xviii, 249 pp., illus. $49.75.

Advances in Nitrogen Fixation Research. C. Veeger and W. E. Newton, Eds. Nijhoff/Junk, The Hague, and Pudoc, Wageningen, Netherlands, 1984 (U.S. distributor, Kluwer Boston, Hingham, Mass.). xxii,

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