the coast. Bishop's contribution is important because he cogently argues that, given technology, the subsistence environment can be viewed as a constant: the fur trade, not the environment, accounts for the genesis of ranking in the interior.

Brian Ferguson, on the other hand, argues that the environment is not reasonably viewed as a constant. Using a snip-and-paste methodology that pays scant regard to time or circumstance and an assertion of "fluctuating resources" made popular by systems ecologists about 15 years ago, Ferguson claims that fluctuations in resources precipitated warfare and that warfare made potlatching and other forms of access to neighbors' resources necessary. A careful reading of Homer Barnett's *Coast Salish of British Columbia* (1955) disabuses us of such a notion. First, guests brought food to feasts and potlatches to which they had been invited. Second, in all likelihood potlatches grew from intravillage distributions after protracted contact with Europeans. As Northwest Coast populations plummeted and the desire for trade goods increased, potlatches were a mechanism to create and maintain alliances so as to avert warfare. But the desire for goods to be used in trading also promoted raiding.

Donald Mitchell and Leland Donald, in separate papers, employ the typology disavowed by Drucker, but in different ways from each other and from Drucker, to account for Northwest Coast polities. A little editorial coordination would have helped here. Donald's essay, which envisions classes and slave exploitation in production, is provocative, if also light in empirical support. On the basis of a single late-19th-century estimate, Donald assumes that slaves made up 25 percent of Northern Nootka populations, being used for production, police, domestic tasks, and ritual sacrifices.

A spate of essays by archeologists deserves mention. Robert Bettinger makes extravagant claims for social stratification, powers vested in "chiefs," and sovereign multilocal village organizations (districts) among the Northern Paiutes of Owens Valley. These Great Basin dwellers, although assumed to be somewhat more complexly organized than their Shoshonean neighbors to the east, have never before had their egalitarian political organizations reconstructed in such a fashion. In making his case, Bettinger confuses post-contact fiestas (fandangos) of the 1870's with pre-contact ceremonials (Big Times), attributes decision-making powers to chiefs where only suasion was present, and alleges that mortuary customs demonstrated that social stratification was present, even though no competent ethnographer has ever mentioned any hint of stratification in Great Basin societies. Oddly, Bettinger does not mention that Owens Valley Northern Paiute villages were organized into reciprocating pairs along the model of reciprocating moieties among their congeners, the Mono of the western Sierra watershed. More important, he does not mention that the reciprocal villages alternately sponsored biannual mourning ceremonies in which decedents during the period since the last ceremony (and all deceased ancestors) were mourned. Such ceremonies, although not uniform in practice, were common throughout California, and Miwok and Monos from California were invited to the Owens Valley, Big Pine, and Bishop events.

This mortuary business, burial remains uppermost, catches the imaginations of other archeologists who contribute to the volume, even though there are no correlations obtained from "ethnographic present" data known to this reviewer between mortuary customs and stratification, or among those variables and economic organization, ceremonial organization, and political organization. Christopher Peebles, for example, in summarizing the developments of prehistoric Moundsville, Alabama, from the 10th to the 16th century, asserts the growth of three hierarchically ranked ritual offices from what was originally a single office, the growth of an elite from 1 percent to 5 percent of total Moundsville society, better diets for the elites, exchange monopsonies (monopolies of trade) controlled by the elite, and still more, all from the analysis of 2000 burials. The nonsequiturs are awesome.

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Water Use in Agriculture

Limitations to Efficient Water Use in Crop Production. HOWARD M. TAYLOR, WAYNE R. JORDAN, and THOMAS R. SINCLAIR, Eds. American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, Madison, Wis., 1983. xx, 538 pp., illus. $30. From a conference, Ithaca, N.Y., Nov. 1979.

Crop scientists generally agree that water supply affects the productivity of field crops more than any other environmental factor that can be managed by humans. The quest for more efficient use of water in crop production has intensified considerably in recent years in view of shrinking water tables, increasing contamination of the surface and subsurface sources currently used, heightened competition with industry for high-quality water, and expansion of crop production into drier regions, both in the United States and abroad. This book, the product of a working session, is an evaluation of the factors that must be taken into account in the management of water resources for agriculture.

More than a decade ago, when a similar symposium was held to consider technical aspects of efficient water use, our concern was more with food surpluses than with how to feed an ever-increasing population. Moreover, during the past decade emphasis has shifted from increasing the acreage of cropland to intensifying production on existing cropland, which requires a more careful look at responsible methods of management of crop production inputs, especially water.

Perhaps the greatest contribution of the volume is that it brings together the work of crop and soil scientists and biological and agricultural engineers. Practically every aspect of crop-water relations is considered—from the time rain or irrigation water passes into the soil and plant until it emerges again into the atmosphere. The book includes a detailed consideration of the relationships of water to shoot and root growth and development and to soil microorganisms and emphasizes how these relationships influence crop yield. For example, soil properties and management systems that affect patterns of water use as related to root morphology are emphasized in a chapter by Klepper, and the management of root systems in a range of soil environments that will lead to the most efficient use of water is discussed in one by Taylor.

Two chapters are devoted entirely, and three in part, to the role of plant breeding in enhancing the efficiency of water use, underscoring recent progress in the manipulation of germ plasm to alter traits thought to affect the process. The point is well made in a chapter by D. K. Barnes dealing with physiological traits associated with efficient use of water that little is known of mechanisms responsible for observed differences among genotypes in this regard. In order for breeders and physiologists to utilize more fully the data being generated on germ plasm as related to water stress a fuller understanding of physiological mechanisms is essential.

Manipulation of the crop is also discussed as a practical and reliable means

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.

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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.

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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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