"communities," "populations," "productivity," "ecologic controls," "postmortem changes," and "application to paleoecology." The topic "communities," for example, is introduced thus (p. 194): "No organism lives by itself. Animals and plants form communities by virtue of their interdependence. The basic communities are sufficiently well known for the associated fauna to be identified by the community name." The author then explains (quoting Thorson, 1957) that there are only two foraminiferal communities known and briefly summarizes the results of a few papers bearing on the subject.

The bulk of the book is a concise summary of field (and laboratory) findings, consisting mainly of distributional information organized by geography (beach, estuaries, lagoons, deltas, various shelves of the world, coral reefs) and presented largely as an annotated bibliography. Thus, the book is admirably suited to answer questions such as "Who did what where?" and "What information is available on forams in mangrove swamps and where can I look it up?" Also, common genera are listed in the appendix and their chief occurrences noted, to provide an answer to "What is the present habitat range of this genus?"

The methods of distributional analysis presented and applied throughout the book are remarkably simple. There are two only, the first being an assessment of diversity, the second a representation of the relative proportions of *Rotaliina, Miliolina*, and *Textulariina* in the various assemblages. To determine diversity, Murray plots "number of species" against the logarithm of "number of individuals." On such semilog plots, the scatter can be described by a straight-line empirical fit and the slope of this line is a function of "α-diversity." A more easily understood number with the same information content would be "number of species expected for a count of 1000 specimens." The author refrains from introducing more complex methods. He does take care, however, to explain in some detail the inherent differences between relative abundance (expressed as percentages) and absolute abundances (expressed as numbers per gram or per volume) in the first six pages of the book.

In summary, Murray's volume is a useful addition to the reference library of the practicing paleoecologist, especially the student of shallow-water benthic Foraminifera. Geologists and graduate students will want to have access to this handy entry into the voluminous and widely scattered literature on benthic Foraminifera.

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Feeding Nations

The Nutrition Factor. Its Role in National Development. ALAN BERG. Brookings Institution, Washington, D.C., 1973. xii, 290 pp. $8.95.

This book is a practical discussion of a major world problem. Large-scale malnutrition, until recently mainly a concern of philanthropists and erudite researchers, has become an increasingly important consideration in development planning. It is evident that solutions will require cooperation between experts representing science and technology on the one hand and politics and administration on the other. Berg has provided an authoritative and balanced introduction to the complex interactions that must be taken into account.

It may seem incidental, but it is worth noting that his book is unusually well written. It reflects Berg's own background in journalism. It is, however, also authoritative in the sense that it brings together selected scientific information from a wide range of disciplines with minimal distortion. It should not be expected to contribute significantly to scientific analysis of nutrition, for that is not its orientation. It draws on the work of international nutrition experts within the broad perspective of a systems approach relating to national nutrition programs and economic issues. It should be most useful to those involved in the implementation of field programs to improve the nutritional status of the poor people of the world. To scientists concerned with nutrition its main value should be in illuminating the relationship between their work and the broader perspective of the world need.

The first three chapters present the problem first in general terms and then specifically dealing with the relationship between malnutrition and development and between improved nutrition and the population dilemma. The next seven chapters review the relevant approaches to a solution. The effects of economic growth, income, and agricultural advance are put into balance by showing that, although they do bring long-term general improvement, they are inadequate for reaching population groups in particular need such as the poor, pregnant and lactating women, and young children. The effects of cultural taboos on social acceptance of new foods are illustrated with many examples. A good analysis of traditional nutrition education places emphasis on the need for more cost-effective approaches. Chapter 7 is particularly important in that it gives a developmental and economic justification for efforts to regain the natural resource lost by the abandonment of breast feeding. Two chapters deal with the possibilities of developing new foods, especially through fortification and new formulations, and the potential role of private industry in such efforts. Chapter 10 presents a balancing of advocates' and adversaries' views of public programs for feeding children. There has been continuing unquestioned acceptance of the tremendous financial investment in such programs with little factual basis for cost-benefit analysis. The point is made that the decisions are often political. Berg's own international experience is largely identified with a major effort to assist India in developing a national nutrition program, and he includes a chapter summarizing lessons learned from that experience. Among the ten lessons he itemizes, number 5 deals with the difficulties of introducing new technology, both scientific and managerial, because of the resistance of well-intentioned critics from both bureaucratic and scientific disciplines. A retired senior civil servant from India recently told me that this was well known there as the Todhunter principle, from a famous memorandum by one of the most senior bureaucrats of the British raj directing that when notes were written in a governmental file their main objective should be to show why the particular proposal would not work.

In the final chapter, "Policy directions and program needs," Berg makes the logical observation that each situation requires its own mix of complementary actions. In general, he places his own priorities as follows: he finds fortification of present foods the most attractive possibility, followed by genetic improvement of seed with associated improvement in agricultural practices. For meeting the highest-

priority need, which is to improve the nutrition of the very young, he urges education to promote breast feeding and innovative ways to get early supplementation with weaning foods. He closes the chapter with a persuasive plea for mission-oriented research.

A minor complaint about the book is that one of the most important sections has been relegated to an appendix. Gunnar Myrdal did the same in his three-volume *Asian Drama,* in which appendix 2 deals with the mechanism of underdevelopment and development and sketches an elementary theory of planning for development. Berg has an appendix D dealing with the methodology of nutrition planning that is a much-needed, concise, and balanced presentation of this increasingly important subject.

The book was written during a euphoric interval when optimism about the Green Revolution was very high. During 1973 we have again become aware of the fragility of the efforts to achieve self-sufficiency in less-developed countries. As a result of an unusual aggregation of severe droughts, famines which are among the most massive of recent world disasters are affecting many millions in Africa and India. Worldwide food shortages produced by crop failures in countries such as Russia and China have made it difficult to mount adequate relief programs. Therefore in some places, for example on pp. 1, 53, and 71, Berg sounds overly optimistic. Appendix A, dealing with the national and international response to the Bihar famine, is in sharp contrast to recent experience in Maharashtra. Anyone who is bold enough to write optimistically about the future of our uncertain world must be prepared for such reversals during a publication lag.

There are a few instances in which Berg seems to have gone somewhat beyond accepted scientific evidence, mainly by accepting a specific point of view which may not be generalizable. On p. 13, for instance, the discussion of the effects of malnutrition on physical capacities does not allow sufficiently for human adaptation to poor diets. On pp. 15 and 16 figures are given for nutritional status as though they represent whole countries whereas they really refer only to specific surveys in parts of total populations or to particular geographic areas. On p. 18, the estimate of $340 million a year as the cost of providing nutritional care for the malnourished children in 37 countries is based on assuming that the care is of the quality provided at special institutions in Guatemala City and Kampala ($7.50 a day per child for 90 days); the fact is that only a few children in the less-developed countries get this sort of care. On p. 38 there is unquestioned acceptance of a far from substantiated published claim that intrauterine devices stimulate lactation. It must be said, however, that the book has remarkably few such problems of scientific interpretation, considering how wide a range of information it covers.

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Prospective Energy Source

Geothermal Energy. Review of Research and Development. H. CHRISTOPHER H. ARMSTEAD, Ed. Unesco, New York. 1973. 186 pp., illus. Paper, $14. Earth Sciences, 12.

In countries plagued by a shortage of fossil fuel reserves or an unfavorable balance of payments there is an increasing incentive to develop indigenous energy sources. Geothermal energy—natural underground heat which can be delivered to the surface—may be able to alleviate the impending shortage. In addition, the development of geothermal energy appears to be less ecologically disruptive than that of fossil fuel or nuclear power.

By reading the voluminous proceedings of the United Nations conferences of 1961 (the Conference on New Sources of Energy, held in Rome in 1961 and published by the U.N. in 1964) and 1970 (the Symposium on the Development and Utilization of Geothermal Resources, held in Pisa in 1970 and slowly being published as special issues of the journal *Geothermics*), one can obtain almost all the material presented in *Geothermal Energy: Review of Research and Development*; however, its organization and the summaries provided by the separate articles make this an extremely useful introductory and reference volume.

As is stated in the preface, the book "makes no claim to being an encyclopaedia of the geothermal arts: it is intended only to be an 'A-B-C' to enable the reader to gain an elementary insight into the various phases of geothermal work, from exploration to utilization, including such related topics as earth structure, geothermal economics and field management."

This volume is one of the two books now in print devoted to the subject of geothermal energy (the other being *Geothermal Energy: Resources, Production, Stimulation*, edited by Paul Kruger and Carel Otte and published in July of this year by Stanford University Press). It begins with a chapter entitled "What is geothermal energy?" In this chapter, the editor explains that "the observed temperature gradient in the outer crust averages only about one degree centrigrade for every hundred feet of depth" and that there are certain regions of the earth with much steeper thermal gradients, "sometimes as much as a hundred times the normal: It is the heat in these regions that is termed 'geothermal energy.'"

The book continues with a rather well-balanced, up-to-date, and authoritative coverage of the total range of subjects involved in the exploration, development, and utilization of geothermal resources. Aside from the unifying theme of geothermal energy, the various chapters of the book are really surveys of subdisciplines and therefore require a working knowledge of a variety of diverse subjects. However, exploration for, and the utilization of, geothermal energy demand the coordinated efforts of specialists versed in different disciplines. Each specialist can better contribute to the goals of the group if he has at least some understanding of the problems and the techniques of his collaborators. This volume provides such insight. In addition to review articles, some original unpublished research data are presented; for example, by Marshall and Braithwaite on corrosion control experiments in New Zealand geothermal fields.

This book suffers, as do many collections of paper from different fields, in that no consistent system of units is used throughout. Each author uses his preferred system, and many of the papers are not even internally consistent. This volume, its conversion table notwithstanding, graphically demonstrates the need for the adoption of one standard system of units! There are moreover a number of typographical errors throughout the text. My main complaint, however, is about the price of $14 for a 186-page paperback that became tattered after one reading.

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