Book Reviews

Social Insects

Biosystematics of Social Insects. Proceedings of a symposium, Paris, 1980. P. E. HOWSE and J.-L. CLÉMENT, Eds. Published for the Systematics Association by Academic Press, New York, 1981. xiv, 346 pp., illus. $68.

It is hard, at first sight, to see how the biosystematics of social insects can form a unified subject. After all, the social insects certainly do not form a monophyletic group, including as they do termites, diverse hymenopterons, and a scattering of other insects such as locusts, certain aphids, and perhaps some beetles and bugs. Nor can the phenomenon of multiple phenotypes for the same genotype be regarded as unifying, because such diversity also occurs in organisms with complex life cycles, such as many parasites.

The unity of social insect biosystematics does not, then, arise because of the systematic problems per se, but rather because of those biological similarities of the creatures that were acquired convergently through their development of sociality. Such biosystematics is a servant, and an outgrowth, of general biological studies on the groups concerned. The resulting fuzziness of the line separating biosystematics from general biology is reflected in this volume, in which "biosystematics" seems to mean any study of systematic significance not concerned wholly with museum specimens studied according to classical intuitive methods. The resulting field is wide indeed, but of great interest to investigators of the biology of sociality.

The 26 papers in this volume concentrate on the "traditional" social insects, with 15 dealing with hymenopterons, eight with termites, and only one with locusts. The emphasis is strongly on empirical studies of real situations; aficionados of the theory of systematics will search in vain for polemical discussions of the virtues of cladistics as against phenetics (in fact, the term "cladistics" does not rate a mention), although there is one paper reviewing multivariate statistics and another discussing the cybernetic aspects of colony function. This empirical stress is, on the whole, a strength of the book, as the result is a wealth of information on social insect biology, bringing out parallels between divergent groups. Thus, the chaotic systematics of the *Formica rufa* group suggests that some of the "species" may be ecological races, distinct in sympatry only when the requisite ecological niches are present, and an apparently similar situation occurs in bumble bees.

There is in fact a strong emphasis on species-level problems. Two papers discuss evidence that sympatric mound types in termites represent sibling species. Others study intra- and interspecific variation in ants and termites, with one morph in an ant turning out to be due to a recessive gene. The techniques involved include biometry and gross chemical analysis, as well as karyotype and allozyme analysis. The latest wave of the future, mitochondrial DNA, is not mentioned, but then very little work on insects has yet been done with it.

Higher-level hypotheses are also tackled. Many species of social insects are known that live in the nests of others, stealing food and even larvae from their hosts. Long ago, the myrmecologist Emery suggested that such species are always close relatives, even derivatives, of their hosts. Allozyme analysis here shows Emery to be right for social wasps, but shows that parasitic bumble bees are monophyletic. Other papers provide syntheses of diverse types of data bearing on the systematics of key groups or consider the evolution of particular organ systems.

Although the wealth of biological detail is a strength, the lack of theoretical rigor and broader treatment does occasionally jar. One exception is a contribution by Claudine Petit, naturally mostly on that honorary social insect (and honorary most other things) *Drosophila*, in which she reviews the neutralist-selectionist debate over allozyme variation, coming down heavily on the selectionist side. But her contribution is only sketchily tied to social insects. Elsewhere, there seems to be confusion between "heterozygous" and "polymorphic," and a solid attempt to compare allozyme variation in termites with that in other organisms is marred by the inclusion of interspecific variation in the heterozygosity estimate presented; such estimates usually refer only to intraspecific or even intrapopulation variation.

Although there has been a long and active tradition of social insect study in Europe, the inclusion of 38 European authors as against only two from elsewhere (India and the United States) does perhaps indicate a geographical bias. Not that this is the fault of the organizers—I know that other non-Europeans were invited, but funds for foreign travel are more restricted now than previously. For U.S. readers, then, *Biosystematics of Social Insects* provides a view of different traditions of approach to, in many cases, genera they are familiar with. In fact, the relative insularity of students of social insects working in certain countries, and on certain groups, has been a hindrance to the field; symposiums and books such as this one should help to build the necessary bridges. At $68 not everyone will want to buy this work, even today, but those who do not should certainly see that their libraries do.

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Forams

Foraminifera. JOHN R. HAYNES. Halsted (Wiley), New York, 1981. xii, 434 pp., illus. $79.95.

The Foraminifera are a class of heterotrophic protists that are ubiquitous in the marine environment. By virtue of the shells they make, which are preserved in the geologic record, they tag marine sediments with time markers and with environmental information. The extraction of this information is the business of biostratigraphy, paleoecology, and paleoceanography. No other group of organisms has proved quite so useful as Foraminifera for these purposes. The chief reason is their great geologic age as a group, their remarkable diversity, their fast rate of evolution, and their abundance, especially in calcareous rocks. The most widespread surface sediment type on earth, for example, is foraminiferal ooze, which covers one-half of the sea floor, or about one-third of the planet.

Haynes has perceived, rightly, "a real need for a general textbook on Foraminifera which lays stress on their stratigraphic application." He has brought together, from a substantial body of literature, the principal aspects of foraminiferal classification and stratigraphic use.

The initial chapters treat laboratory methods, generalities about life cycles, test morphology and composition, and

principles of classification. The main body of the book is devoted to a systematic (albeit brief) summary of useful information about the various orders, starting with agglutinating Foraminifera and ending with the globigerinids. Each chapter gives a survey of morphology and taxonomic principles, phylogeny, stratigraphic applications, and examples from biogeographic and related "ecologic" studies (diversity plots, depth distributions, facies association, and so on). Essentially, Haynes provides a review of basic material that is necessary if, for example, one wishes to show students how to work with fusulinids in the late Paleozoic. The literature cited is extensive and is international in scope. Illustrations range from adequate (line drawings) to excellent (scanning electron micrographs), although coverage is necessarily spotty for those groups that exhibit great diversity.

The book, then, is a utilitarian contribution to the "training" aspect of the micropaleontology profession: it is written with oil geology in mind. The depth of treatment of academic questions—principles of classification and of stratigraphy, and evolutionary theory—is strongly influenced by the utilitarian aspect of the book. Thus, paleobiologists will not find their pet subjects of discussion aired here. The enormous progress of the last dozen years in the quantitative treatment of faunal data, for the purpose of environmental reconstruction, is touched on in the last chapter, on globigerinids. In this chapter, also, stable-isotope analysis is briefly discussed.

In essence, the book reflects the now classic and fruitful marriage of paleontology-stratigraphy with sedimentology-paleoecology, which peaked in the '60's. It should prove valuable for introductory courses in micropaleontology. For a taste of where it's at, however, I would suggest supplementing it with more specialized works covering recent advances in oceanic micropaleontology (for example, R. M. Cline and J. D. Hays, "Investigation of Late Quaternary Paleoceanography and Paleoclimatology," *Geological Society of America Memoir 145* (1976); A. T. S. Ramsay, *Oceanic Micropalaeontology*, vol. 1, Academic Press, 1977; B. U. Haq and A. Boersma, *Introduction to Marine Micropaleontology*, Elsevier, 1978; J. H. Lipps *et al.*, *Foraminiferal Ecology and Paleoecology*, Society of Economic Paleontologists and Mineralogists, 1979).

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Development of Germ Cells

Primordial Germ Cells in the Invertebrates. From Epigenesis to Preformation. PIETER D. NIEUWKOOP and LIEN A. SUTASURYA. Cambridge University Press, New York, 1982. xiv, 258 pp., illus. $59.95. Developmental and Cell Biology Series, 10.

This is the second of two books in which Nieuwkoop and Sutasurya examine the origin and development of the primordial germ cells in the animal kingdom. Having examined the chordates in the companion volume (*Primordial Germ Cells in the Chordates: Embryogenesis and Phylogenesis*, 1979), the authors have now turned to the analysis of the invertebrates. The levels at which this analysis can be carried out in the two animal groups are not entirely comparable. Because the chordates are in fact a rather homogeneous group, the origin and development of germ cells in the phylum can conceivably be analyzed against the background of both phylogeny and embryonic development. On the other hand, the phyla comprised by the invertebrates are so highly heterogeneous as to make possible the analysis of the origin of germ cells in these groups only in the context of their embryonic development. As a result, the invertebrate phyla are arranged according to their taxonomic classification and no attempt is made to correlate them phylogenetically. In spite of these limitations and the disparity of data available in the various invertebrate phyla, the authors have accomplished their goal of providing a comprehensive review of invertebrate germ cell development. The material for each phylum is presented in a rather concise but exhaustive fashion and includes a variety of data on embryonic development, mode of reproduction, and regenerative capacities whenever present.

The picture that emerges shows that primordial germ cells in invertebrates develop according to highly divergent mechanisms. In most primitive invertebrates, the origin of germ cells is basically epigenetic, for they can develop from various types of somatic cells under the inductive influence of some organ anlagen or environmental factors. This is in sharp contrast with higher invertebrates, where cell-specific germ plasm and early segregation from somatic cells make the development of germ cells strongly preformistic. An "intermediate" mode of germ cell development can also be envisioned in those invertebrate phyla—annelids, echinoderms, and mollusks—in which segregation of germ cells from previously somatically committed cells occurs rather late in embryonic development. The evidence gathered in the book leads to the unavoidable conclusion that the classic distinction between germen and soma drawn from Weismann's *Keimplasma* theory is no longer tenable. In opposition to the old-fashioned idea of an immortal germ line, Nieuwkoop and Sutasurya propose that germ cell development is a special mode of cell differentiation in which the acquisition of a differentiated state does not ultimately result in loss of totipotentiality.

Looked at from this standpoint, the development of germ cells has a much wide contour than had previously been assumed, so as to include all cells that may potentially develop into germ cells.

On the whole the book appears to be a well-balanced survey of the wide mass of data available on the subject. The reader interested in this literature will appreciate the effort put forth by the authors to present a unifying view of a controversial topic.

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Olmec Archeology

The Olmec and Their Neighbors. Essays in Memory of Matthew W. Stirling. Michael D. Coe and David Grove, organizers. ELIZABETH P. BENSON, Ed. Dumbarton Oaks Research Library and Collections, Washington, D.C., 1981. xii, 346 pp., illus. $30.

By following up the explorations of his predecessors in the jungles of southern Mexico, uncovering numerous additional monumental sculptures, finding some spectacular jade offerings, and popularizing his adventures in the pages of the *National Geographic*, the late Matthew W. Stirling was single-handedly responsible for the greatest surge of enthusiastic interest that Olmec archeology has yet received. The organizers of this volume have gathered a score of essays honoring his memory, presenting them under a title for whose inspiration they turned to the famous festschrift for the Mayanist A. M. Tozzer. The essays are mainly of interest to the academic specialist, but several have more general interest and broader significance. My remarks here are directed toward two whose subject matter is particularly familiar.

Olmec sculpture was a focus of Stirling's explorations, and fine Olmec art