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ALLER, J. Y., S. A. WOODIN, AND R. C. ALLER [EDS.]. 2001. **Organism–sediment interactions.** University of South Carolina Press. xxi + 403 p. US$60. ISBN 1-57003-431-1.

Benthic ecologists have tended to suffer from a lack of textbooks and monographs. In biological oceanography texts, benthic topics are typically spread across chapters that deal with habitat, with little opportunity for synthesis by ecological process. Marine ecological texts, of necessity, treat the whole ocean, water column, and seafloor, and often the latter is presented only superficially in the final chapter. This book, which presents contributions from an October 1998 symposium workshop, whose goal was to address persistent research questions and future research opportunities, is thus a welcome addition to the literature on soft-sediment benthic ecology.

The book lacks an explicit definition of organism–sediment interactions, but that of Donald C. Rhoads (1974, p. 265)—a pioneer in this area of research and to whom this book is dedicated—serves well: the study of biological activities of benthic macrofauna that influence physical-chemical properties of the muddy seafloor and the ecological feedback of these biogenic changes. The editors have done a fine job of assembling a volume with broad topical, geographic, depth, and habitat coverage to address this subject. The 23 chapters from more than 80 contributors are organized in five sections: technological advances, biogenic modification of physical properties, response to sedimentary disturbances and paleoecological indicators, biogeochemistry and bioturbation, and sedimentary food resources and digestive strategies.

The themes of advanced technology and innovative methodology introduced in the opening chapter of Rhoads et al. animate many contributions. Sediment profiling cameras are used for quantifying in situ activity (Diaz and Cutter) as well as a companion to standard benthic monitoring (Keegan et al.). Koenig et al. describe do-it-yourself planar optodes to profile multiple chemical species in intact cores, or even in situ. In vivo microfluorometric and colorimetric techniques are being developed especially for use within individual worm guts (Ahrens and Lopez). Thrush et al. use video transect data and statistical analysis over a range of spatial scales to show how suspension-feeding bivalves, notably by their size and spatial arrangement, determine macrofaunal abundances in the surrounding community. On a fundamental statistical issue, Germano argues that it is time to abandon significance tests for benthic data in favor of decision theory and Bayesian approaches.

Mathematical models are often used to quantify organism–sediment interactions, and they figure prominently here. François et al. develop mechanistic time- and space-dependent models of bioturbation based on functional groupings. Wethey et al. use coupled differential equations that account for how disturbance alters sedimentary ‘‘geochemical recovery,’’ which in turn affects benthos and is particularly significant with respect to larval habitat choice. Aller et al. review models of decomposition of organic matter, particle reworking, and solute exchange; as illustrated in their Fig. 8, changing even a simple parameter like density of burrows has the potential to drive geochemical reaction dominance in sediments—in this example, nitrification versus denitrification.

Organisms interact with sediments at all depths, but logistic constraints might necessitate different techniques. Blair et al. use multiple stable and radioisotope tracers for biochemical studies in slope sediments, finding that biology matters but its importance varies along a depositional gradient on the continental slope. Smith et al. also use multiple tracers in order to test three mechanistic models of age-dependent bioturbation, documenting rapid subduction of young material in the deep sea. Sediment tray experiments reveal that faunal–geochemical interactions are just as prevalent (and likewise species-dependent) in lakes as in the ocean, and Soster et al. develop a concept of ‘‘geochemical succession’’ reflective of porewater changes driven by biology.

Succession, recruitment, and other benthic processes are the focus of several papers. Using Long Island Sound benthic data, Zajac argues that macrofaunal assemblages can reach multiple community endpoints by multiple pathways. Whitlatch et al. discuss the significance of larval versus postlarval colonization, predicting scale-dependent recolonization rates and reporting data from a novel sampler of their own design. Hypoxia, sedimentation, and hydrodynamic disturbances are considered in Schaffner et al., amply illustrated with their extensive work in the York River–Lower Chesapeake Bay estuaries.

Much can also be gleaned from the buried or fossilized records of benthic communities. Young et al. find turbidities to be relicts of past disturbance that do not in general reflect equilibrium responses to the environment. Kidwell's results show that analysis of dead shells in benthic samples captures important ecological characteristics and offer hope that community analysis can be extended back through time using molluscan death assemblages. Through taphonomic experiments, Parsons-Hubbard et al. find that burial of shells, even a dusting of sediment, can greatly alter the preserved faunal record.

Several papers remind us that plants, too, are organisms and participate in interactions with the substratum. Mangrove roots, crab burrowing, and flushing by a large tidal prism maintain oxidized and suboxic sediments despite considerable leaf litter input (Alongi). Kristensen and Pilgaard recount how the eating of green mangrove leaves by crabs retains organic carbon in the canopy. As much as a comprehensive treatment is desired, these readings show that it sometimes, irreducibly, comes down to individual, often quirky, biology. Such is the essence of organism–sediment interactions.

Sediments are not just home, but food, for many benthic fauna, and here can be found some of the most intimate and challenging interactions. Mayer et al. show how deposit feeders can use extracellular digestion in their tubular gut to advantage, a strategy that might have driven metazoan evolution. In what are surely the most stimulating analogies in this volume, deposit feeding is compared at times to laundry technology, household batteries, and even guerilla warfare. Levinton et al. argue that we must connect bivalve suspension feeding to water column processes and regulating factors. Despite our extensive knowledge of feeding mechanisms and controls on selectivity and rejection, such a linkage between individual-based and ecosystem models remains elusive.

This book fills several needs. It is a valuable snapshot of research on organism–sediment interactions, especially of the new technologies and methods. Individual papers will be excellent fodder for graduate seminars in benthic ecology and engaging entrées into the journal literature for students; a stimulating reading list could be drawn from this book supplemented with papers on boundary layer processes from Boudreau and Jørgensen (2001). In sum, this is an attractive, affordable, and valuable textbook resource for all soft-bottom benthic ecologists.

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References

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