# REVIEWS

*Packrat Middens: The Last 40,000 Years of Biotic Change.* Edited by J. L. BETANCOURT, T. R. VAN DEVENDER, and P. S. MARTIN. 1990. University of Arizona Press, Tucson. vii +467 pp. Hardcover: $55.00, ISBN 0-8165-1115-2.

The analysis of remains from packrat (*Neotoma* sp.) middens has accelerated the study of paleoecology in the arid regions of North America. Packrat middens are discrete deposits of fossil materials (primarily plant debris, but including also vertebrate remains, arthropods and pollen) that have been cemented together and preserved by the urine and feces of the packrat itself. In an area where traditional sedimentary deposits (such as lakes and bogs) with well-preserved organic remains are rare, midden analysis has been particularly helpful in our interpretation of biotic and biogeographic change over the last 40,000 years. Over 1100 middens have been analyzed from eleven states in the U.S. as well as five in Mexico, providing a large amount of data on biotic change through time and in space.

This book contains 21 chapters written by 26 authors. It is divided into four sections, with an introduction and a summary. The introduction serves as a history of the subject, from the initial reports of the deposits in 1849 to the first publication involving midden analysis in 1964. Part I contains papers pertaining to the ecology of the packrat as well as methodology of the subject and interpretation of the data. It becomes clear from these discussions that a tremendous database exists, but standardization of methods and quantitative interpretation of vegetation has not yet been accomplished. This is often the case in a young, developing field of research.

For individuals interested in regional vegetation and climate reconstructions, Part II is the heart of the volume. Regional summaries are provided for the Chihuahuan, Sonoran, Mojave and Great Basin deserts, as well as the Grand Canyon and Colorado Plateau. Most summaries include a synopsis of major vegetational change, with sections on biogeographic and paleoclimatic implications. The authors have done an admirable job in summarizing the available data for each region.

Part III includes five chapters that detail specialized studies. These studies include comparison of midden deposits with contemporaneous sediments from nearby lakes, implications for the occurrence of grass species in middens from the Sonoran Desert, mammalian and arthropod remains from Chihuahuan and Sonoran Desert middens, respectively, and climatic implications of deuterium concentrations in plant cellulose. The chapters are representative of a range of special investigations possible from middens. Additional subjects could have been included, such as the pollen, herpetological and archeological records from middens.

Part IV, entitled "Middens Abroad", presents three chapters that explore similar deposits from other regions of the world. These include the potential for analysis of hyrax (Procaviidae) and dassie rat (Petromuridae) in the Middle East and Africa, as well as the stick-nest rat (Muridae) from Australia. For several of these animals, the chapters here represent the only publications on the subject. The potential for the Middle East is particularly exciting, as little is known about the characteristics of native vegetation prior to the advent of agriculture, and the subsequent human impact on the remnants of natural vegetation.

The book is technically well-crafted and well-edited—typographic and lay-out errors are few. All considered, this book provides an excellent reference for midden analysis. However, those persons interested in the fossil record from other types of sedimentary deposits (e.g., lake sediments, alluvial sections, etc.) will need to look elsewhere. I recommend this book to all individuals interested in perspectives on

changing environments through time, and on the biogeography of the western U.S. and Mexico. This would include individuals as diverse as botanists, ecologists, zoologists, Quaternary scientists and resource managers. The volume is particularly timely in light of current interest in global climate change. Arid regions may be among the most severely impacted regions of the world.

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*Vernal Pool Plants: their Habitat and Biology.* Edited by D. H. Ikeda and R. A. Schlising. 1990. Studies from the Herbarium, California State University, Chico, Number 8. xi + 178 pp. Softcover: $11.00. (Available from Herbarium, CSU, Chico, CA 95929.)

This attractive and inexpensive book includes the eight papers delivered at a symposium of the same name at the Pacific Division meetings of the American Association for the Advancement of Science at California State University, Chico, in June 1989. Remarkably, the publication appeared exactly one year after the symposium, doubtless possible because of desktop publishing methods; the manuscripts were read by outside reviewers. According to the editors, the symposium was "designed to emphasize biological and environmental information on the plants of vernal pools—information which may be of interest and of importance in wetlands research and conservation."

Jokerst's contribution is concerned with volcanic mudflow vernal pools, mostly in the Sacramento Valley. Species richness of vernal pools appears to be weakly associated with the area of a pool; Jokerst suggests that it is also weakly correlated with pool depth. The uniqueness of the individual florulas of pools in close proximity that has been noted by others is confirmed, and Jokerst determined that often, but not always, pools near each other have greater floristic similarity than to those more distant. The methods he uses in his analyses will be of interest to those concerned with characterization and comparison of vernal pool floras elsewhere. Holland and Dains emphasize the fact that substrate characteristics have a strong influence on vegetation patterns in vernal pools, and that these substrate variations are often so local that they do not appear on standard soil survey maps. These authors conclude that mitigation efforts by developers will ultimately fail because the subtleties of edaphic influences are not taken into consideration in such efforts and probably could not be accommodated if they were. Hanes, Hecht, and Stromberg conclude that direct precipitation rather than watershed inflow is the primary source of the water that fills vernal pools in the Sacramento region, although subsurface inflows may help maintain water volume once the local soil becomes charged with water. Keeley, working with southern California pools, notes the sequential leaf heteromorphism that is so common in vernal pool plants during a given growing season, and contrasts the types of photosynthesis carried on by aerial versus submerged leaves. Despite the gross morphological convergences that may exist among many unrelated vernal pool denizens, each may display a characteristic and different spectrum of physiological attributes. He also concludes that differences in numbers of individual species in a pool in dry versus wet years is attributable to interspecific differences in photosynthetic rates in dry versus wet conditions. Stone suggests that the majority of vernal pool endemics are of recent evolutionary origin, this speciation often associated with aneuploid