interests, one wonders whether we may be getting too "objective" an account. There remains an imbalance among the essays with respect to the adequacy with which different factors are considered. A balanced account does not result from the mere juxtaposition of partial viewpoints.

This volume provides a striking number of examples of theories that have successfully accounted for a significant fraction of the known phenomena, only to have to be abandoned. Darwin wrote, in defense of his own theory, that one would not expect a false theory to explain so much. Alas for the defenders of many a good-looking theory, neither history nor philosophy sanctions such an intuitive conviction.

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Invertebrate Paleobiology

The Ammonites. Their Life and Their World. ULRICH LEHMANN. Translated from the German edition (Stuttgart, 1976) by Janine Lettau. Cambridge University Press, New York, 1981. xiv, 246 pp., illus. $19.95.

In this book, somewhat updated in the translation, Lehmann draws extensively from European examples to illustrate major aspects of ammonite paleobiology. His intention is to take ammonities, superb biostratigraphic markers that they are, and view them as living creatures. The strongest portions of the book develop this theme, dealing with paleobiological topics that Lehmann personally has researched: sexual dimorphism and ammonite jaws and radulae. Lehmann expands his earlier articles into a coherent chapter on ammonite jaw shapes and the relationships between aptychi and possible modes of feeding. Aptychi are clearly shown to be part of the jaw apparatus, rather than opercula as previously thought.

The book is aimed at nonspecialists. As a researcher interested in ammonites, I felt a slight unease, stemming not from the contents but from the topics that are not covered. Ammonites are fascinating because of their peculiar evolutionary history of high speciation rates followed by spectacular extinctions and because of the extraordinary complexity of their chambered shells. Lehmann addresses both of these topics in only cursory fashion. Jurassic and Cretaceous ammonites showed some of the most spectacular expansions and declines in the fossil record. The ammonites of the Jurassic served as the basis for the pioneering efforts in biostratigraphy of the last century, by such forefathers as d'Orbigny, Quenstedt, and Oppel. The strength of Lehmann's work has been in looking at ammonites as once-living organisms. Such an approach could have been enlightening if used in an evolutionary context. Second, the great debate about the ammonite suture, whether it served as a strengthening device or an aid to buoyancy control, is not discussed. It is perhaps no accident that the increase in sutural complexity in the Ammonoidea is matched by an increase in diversity. More insights into the use of the complex septa in the living ammonite, including a discussion of the Westermann-Bayer debate, would have been welcome.

The book will be welcome to anyone wishing easier access to this baffling but fascinating group. It is easily the best summary to date in a rapidly expanding field.

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A cast of one of the largest ammonites ever found, *Parapuzosia seppenradensis* (H. Landois), Upper Cretaceous, Seppenrade near Münster in Westphalia (West Germany). Diameter 1.7 meters. [From *The Ammonites*]

Archeological Strategies

Foundations of Northeast Archaeology. Papers from a conference, Albany, N.Y., Feb. 1980. DEAN R. SNOW, Ed. Academic Press, New York, 1981. xiv, 270 pp., illus. $19.50. Studies in Archaeology.

According to editor Snow, the purpose of this volume is to explore the "range of problems, possible research strategies and possible solutions" appropriate to the archeology of northeastern North America. Though a collection of seven individually authored conference papers is probably not the ideal instrument for this purpose, the book does include some valuable and stimulating discussions of topics important to northeastern archeology.

Bruce Trigger's lead-off paper, "Prehistoric social and political organization: an Iroquoian case study," presents an extensive critical review of research concerning these topics and other aspects of Iroquoian culture and environment that bear upon them. Trigger advocates a strategy for future research that includes the refinement of chronologies, extensive (even total) excavation of sites, and more careful study of artifact distributions. This strategy will be criticized by deductivists and particularly by advocates of the "conservation ethic," but the problems he addresses are complex and his aggressive stance therefore is probably justified.

Dena Dincauze's "Paleoenvironmental reconstruction in the Northeast: the art of multidisciplinary science" is, in her words, "a multifaceted review" of an approach that has figured prominently in her teaching and research. That approach rests upon "collegiality" among

researchers from a variety of disciplines and the avoidance of "excessive empiricism and excessive theoreticality." After a useful summary of relevant natural scientific techniques, she discusses models as a means of bringing such techniques to bear upon archeological issues. Her move away from rigid empiricism is apparently an attempt to transcend the limited, often univariate, nature of past models in the northeastern literature and to achieve a level of comprehensiveness more in accord with her ecological perspective.

As an example of her approach, she tackles the issue of Paleo-Indian subsistence and states: "We cannot escape the conclusion that Paleo-Indian peoples were far more likely to have been generalist foragers than specialists in big game." Unfortunately, those who disagree with this conclusion, and there will be many, may overlook the real advantages of the approach she espouses.

Snow's contribution to the volume, "Approaches to cultural adaptation in the Northeast," resembles arguments by Diener and others advocating the macroevolution model of biological speciation as an analog for quantum cultural change. Invoking Liebig's law of the minimum, Snow suggests that apparent cultural discontinuities in the Northeast may have resulted from "short term episodes of environmental stress" that led cultural systems to quantum change or to total collapse and replacement by "systems expanding from adjacent areas." He goes on to suggest that such discontinuities can be modeled by catastrophe theory. At times, Snow carries his argument to extreme, as for example when he states that "general environmental trends such as climatic episodes are important to us not in and of themselves . . . but to the extent that they increase the frequencies of such rare catastrophes."

The verifiability of Snow's neocatastrophism model depends upon our ability to detect the short-term phenomena that supposedly caused cultural change. Snow himself seems unsure whether this is possible, but even if it is the model will enlighten us only about the timing and magnitude of such changes. The process of subsequent readaptation remains unaddressed. Finally, Snow's stated intent is to develop models scaled down to levels appropriate for the region's archeological data base. In fact, however, models such as macroevolution and catastrophe theory cover broader ranges of phenomena than those now represented in the literature.

William Starna's "Old data and new models: bridging the gap" summarizes the literature on models and their role in scientific inquiry. His concise and readable presentation will serve as a handy pocket guide to models in the North American literature. Starna devotes a surprising amount of attention to "old boy networks," which he calls "controlling models" and which operate to restrict outsiders' access to unpublished data, working assumptions, and the like. In other fields, such as history and literary criticism, such models may prevail, but Starna credits them with far more influence among archeologists than they have. Data remain too long unpublished more often because of research programs imbalanced toward data recovery and because of lack of support for analysis and publication than for any other reason. However, in those cases where controlling models are operative, the cause may lie in a phenomenon which, to his credit, Starna broaches in this paper, that is, the recent emergence of a "division of labor between those who formulate hypotheses and those who test them." Could it be that "controlling models" sometimes arise when one's customary right to first publication of recently acquired data or newly developed interpretations is abrogated by someone else's publication of a hypothesis inspired by them?

Douglas Ubelaker's "Approaches to demographic problems in the Northeast" briefly reviews past efforts in northeastern paleodemography and asserts that future progress will depend upon systematic analysis of skeletal data. Debra Schindler *et al.* discuss some physical anthropological aspects of skeletal remains in "Biocultural adaptation: new directions in northeastern anthropology." The authors feel that past attempts to measure genetic distances between skeletal populations in the Northeast failed on either technical or theoretical grounds. Instead, they espouse the use of skeletal material to study prehistoric adaptation.

Finally, Francis McManamon's paper describes a multiyear, multistage archeological survey of Cape Cod National Seashore. He lays out the goals, research methods and techniques, and results of the project clearly and concisely. This paper exemplifies well-designed and well-executed field survey.

Since these papers were prepared, financial support for archeological research in North America has waned. Unfortunately, the impact is likely to fall heavily upon the more dynamic strategies advocated in this volume, designed as they were for maximizing creativity, not cost-effectiveness. But even if we are forced to forgo for a while large data-recovery projects in Iroquoia and complex multidisciplinary research endeavors, this collection will remain useful in polemical and instructional contexts because of its varied perspectives on regional methodological and theoretical issues.

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Color Vision in Vertebrates

Comparative Color Vision. GERALD H. JACOBS. Academic Press, New York, 1981. viii, 210 pp., illus. $24. Academic Press Series in Cognition and Perception.

In those species that have been carefully studied, color vision is achieved by specialized receptor cells with different spectral sensitivities and by comparing the responses of these receptors in antagonistically organized neural networks. Color vision varies across species because of differences in the number of receptor types and their spectra and also because of associated differences in the number and character of the antagonistic neural networks.

This book begins with a discussion of the most important methodological problem in the field: How does one determine that an animal does in fact have color vision? Any discrimination can potentially be made by responding to brightness differences instead of color differences. Indeed, as Jacobs points out, animals whose color vision has been established beyond doubt sometimes prefer to make choices on the basis of brightness. Such animals may need encouragement before they adopt a color-based strategy. The methodological discussion, emphasizing the need to settle the brightness question, provides the background for the research that will be emphasized by Jacobs. He mainly covers data from those species that have been studied in properly designed experiments. Work that does not satisfy rigorous criteria is only mentioned in passing.

Jacobs then presents those fundamental facts of psychophysics and neurophysiology that are relevant to color vision. These chapters are tightly written and presuppose a general background in sensory psychobiology.

The heart of the book is a comparative