

year later, Bennet and Manuel unequivocally confirmed previously weak evidence for an excess of ^{129}Xe (from decay of the extinct radioactivity ^{129}I) in CO_2 from a gas well in New Mexico. It was clear almost immediately from each of these observations that outgassing of a juvenile gaseous component residing within the earth persists visibly until the present. The successful and energetic development of helium isotopic studies by Craig and co-workers in America and by Tolstikhin and co-workers in Russia has been the most exciting aspect of the modern work in terrestrial rare gases, and the book contains good papers by Craig and co-workers and by Tolstikhin that exhibit interesting geographical patterns in the efflux of the primordial gas. Tolstikhin, who unfortunately was unable to attend the seminar, has nevertheless contributed a fine review of the latest Russian work. That work had previously been of only limited accessibility to scientists who don't read Russian. As reviewed by Tolstikhin the work is impressive both in scope and quality; his review will justify owning the book for many.

The majority of space in the book is devoted to outgassing models for the earth and to the utilization of argon and helium data for the mantle to fix parameters in such models. The papers by Tolstikhin, Manuel, Bernatowicz and Podosek, Hamano and Ozima, Fisher, Schwartzman, and Hart and Hogan all deal with this subject, at least in part. I wish I could say that some sort of helpful consensus emerges from all that writing, but it does not. Unevenness in the quality of the papers is one of the difficulties, but a more basic problem, expressed clearly in the long but readable review by Bernatowicz and Podosek, is that input parameters for the models, such as the potassium content and the ratio $^{40}\text{Ar}/^{36}\text{Ar}$ for the mantle, are not sufficiently well known to constrain models usefully. We are just at the point where we can identify juvenile outgassing from the mantle, but we do not yet have measurements of the isotopic composition of rare gases that we can be certain are representative of the mantle as a whole, or even regionally.

In short, the book is a useful glimpse of what is happening in this field and will be valuable to specialists. Those outside the field who wish to make use of its fruits would best bide their time. The papers in the book are enticing, but the payoff is not yet at hand.

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Fossil Communities

The Ecology of Fossils. An Illustrated Guide. W. S. MCKERROW, Ed. MIT Press, Cambridge, Mass., 1978. 384 pp., illus. \$22.50.

Four decades ago, Maxim K. Elias published in the *Geological Society of America Bulletin* a diagram showing a comparison of fossil animal and plant associations in the Permian "Big Blue" deposits of Kansas with modern shallow marine benthic communities. This diagram set forth the way of explaining the fossil record that, continuing with A. M. Ziegler's highly influential papers on Silurian communities beginning in *Nature* in 1965, culminates in the present book exemplifying the "community approach" to paleoecology.

The essence of *The Ecology of Fossils* is a series of 125 black-and-white block diagrams (plus a page or so of text for each) showing assemblages of fossil animals on the ocean bottom around Great Britain from the Cambrian to the present. The breadth of coverage over geologic time within one publication is unique and provides the main fascination of the book. Although some of the "snapshots" may not conform entirely to reality, there appear to be no time-dependent systematic biases that would interfere with several general conclusions to be drawn from the book. As I will explain, the errors in the figures are of the sort that exist when a photograph labeled "The Family" shows a local family standing together on the front porch and also includes a couple of in-laws who happened to be visiting from out of town.

As other reviewers of this book have documented, some fossils shown together in some diagrams in fact are not normally fossilized in the same beds. In addition, the crowding together of fossils in

the reconstructions is sort of like having all of the family line up on the porch—they don't normally occur that way, alive or dead. A judgment based on a particular taxon in a particular figure could therefore be in error, although in the absence of time-dependent systematic errors such properties as the size of the family group, the general dress and appearance, and the functional morphology reasonably can be inferred. Thus my basic judgment of the book is that it is most interesting, reliable, and useful as a general book to show what one should and can look for in fossil assemblages rather than as a specialist's handbook of facts correct in every detail.

One question the reader may have is whether the communities are "representative" of those that actually existed during the Phanerozoic. To investigate this, I compiled Table 1, in which each of the 98 marine assemblages is placed in one of seven categories according to substrate. Of the assemblages in Table 1, approximately 45 percent would be considered to be in limestones, 15 percent in sandstones, and 40 percent in shales. In the geologic record as a whole, approximately 20 percent of the rocks are limestones, 30 percent are sandstones, and 50 percent are shales. Thus the biological assemblages shown in McKerrow's book would have too little representation of assemblages from shales and too large a representation from limestones (especially reefs) relative to what is found in the geologic record as a whole. Whether or not the assemblages are proportionately representative of rock types of Great Britain, which is the source of nearly all the assemblages, is not known.

We can also ask how representative biologically are the assemblages in this book with respect to the original assemblages. A few generalizations seem to apply.

Table 1. The 98 marine assemblages of *The Ecology of Fossils* categorized by geologic age and by substrate in which they occur.

Geologic age	Number of assemblages						
	Terrigenous mud	Algal mud	Terrigenous sand	Coral-algal-shell sand	Reef	Hard ground	Basin
Cambrian	3						1
Ordovician	7	2	1	1			2
Silurian	5		3	2	1		2
Devonian	2		1	1			1
Carboniferous	2	2		5	4		2
Permian				1	1		
Triassic							0
Jurassic	5	4	2	7	2	3	1
Cretaceous	6		2	4		3	
Cenozoic	2		5				
Total	32	8	14	21	8	6	9

1) Aside from Mesozoic ammonites, there are few indications of mobile carnivores in the depicted assemblages. This leads two of the authors to the conclusion that "it is unlikely that there were many active carnivores in the Ordovician" (p. 72). As likely in this reviewer's opinion is that the nature of most of the active carnivores is not to have a thickly mineralized skeleton, so that their presence would, almost by definition, be underrepresented.

2) There are only a few indications (aside from burrows!) of mobile infaunal dwellers.

3) The assemblages are dominantly either suspension feeders (usually most abundant in environments inferred to have been strongly agitated or shallow) or stationary detritus feeders (usually most abundant in environments inferred to have been weakly agitated or deep, where edible organic matter is not so readily oxidized).

The fossilized suspension-feeding organisms include all of the brachiopods, crinoids, bryozoans, corals, and sponges and some bivalves. The fossilized detritus-feeding organisms include the trilobites, many gastropods, and many bivalves. Taken together, the suspension feeders and detritus feeders broadly represent the organisms that remain (and feed) in one place for long periods of time. In modern faunas, this mode of life is strongly related to the occurrence of thick hard parts. These "shelly faunas" may contain approximately 70 percent of the "sessile" genera that originally existed in the assemblages. If so, the assemblages shown in the book are representative of most of the benthic "stationary" genera originally present, but they would underrepresent most of the mobile fauna originally present.

The next edition of the book might benefit from some additions. One is a consideration of the matter of nomenclature for the assemblages. At present, some assemblages are named after genera, others after broader taxa, others after a position on the shelf, others after substrate type, and yet others after position on a reef. The variety of designations inhibits comparison of assemblages of different ages and reflects historical accident rather than conceptual analysis. The editor of such a book is in a position to provide coherence on this nomenclatural matter. Another useful addition would be an essay treating the question of how and in what way the recorded assemblages seem to be, and not to be, representative of both the inferred and the observed geological record. The nature of the fossilization potential of different

assemblages, of different environments, and of different modes of preservation should be discussed. Maybe the observed fossil record has more to do with chemistry (through diagenesis) than with biology; what then? Also useful would be a table of contents that included all the subdivisions of the chapters, instead of just listing the communities discussed. Finally, one misses a map of Great Britain showing all the places (and there are many) mentioned in the text.

In concluding this review, I am reminded of yet another way to evaluate the book. One could take the 98 most diverse marine assemblages listed by Bambach in *Paleobiology* (1977) according to their proportionate representation by geologic age in McKerrow's book (four Cambrian, 13 Ordovician, and so on) and ask if one would end up with a similar picture of assemblages over geologic time. Certainly the general impression one gets from the pictorial representations of McKerrow's book coincides with Bambach's main conclusion that the number of taxa per fossil assemblage increases significantly through geologic time. Although there are problems such as might be expected in a pioneer effort at synthesis, the broad viewpoint adopted in McKerrow's book will lead to a much more comprehensive view of fossil assemblages than heretofore has been possible.

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Behavioral Pharmacogenetics

Drugs and the Inheritance of Behavior. A Survey of Comparative Psychopharmacogenetics. P. L. BROADHURST. Plenum, New York, 1978. viii, 206 pp. \$19.50.

Behavioral pharmacogenetics is an emerging discipline that can broadly be defined as the study of the relative contribution of genetic factors to individual differences in behavioral responses to pharmacologically active agents. As the carefully chosen title and subtitle of this book suggest, it is the merging of elements of common interest from the fields of pharmacology, genetics, and psychology. Earlier comprehensive treatments of the topic include *Psychopharmacogenetics* (B. E. Eleftheriou, Ed., Plenum, New York, 1975) and Broadhurst's own chapter in volume 7 of the *Handbook of Psychopharmacology* (L. L. Iversen, S. D. Iversen, and S. H. Snyder,

Eds., Plenum, New York, 1977). The present monograph is a significant extension of the earlier chapter by Broadhurst.

It should be noted that there are at least two general strategies that can be used to study behavioral pharmacogenetics. One approach is to use the tools of genetics to produce or find subjects that differ in their behavioral responses to drugs and then to look for underlying physiological or biochemical mechanisms that might mediate the differences. The second approach, which might be considered an extension of the first, is more concerned with using the tools of behavior-genetic analysis to reveal as much as possible about the genetic architecture of the drug-induced phenotypes. It is the latter, biometrical approach that Broadhurst takes as a frame of reference.

Although the monograph was not designed as an exhaustive review of the literature, I found it to be remarkably thorough in its coverage of recent studies. An index of this thoroughness is the inclusion of results that were reported as abstracts of papers presented at various scientific meetings. The coverage of the literature is augmented by summaries presented in tabular form. A major part of the monograph consists of three chapters on strain and species differences in responses to amphetamine and other stimulants, to nicotine, anxiolytics, convulsants, and amnesics, and to alcohol, opiates, and barbiturates. These chapters provide a valuable summary of the designs and results of studies using a strain comparison approach. In addition, the author suggests ways in which these studies could be fruitfully extended in future research.

In other chapters, selection, diallel crossbreeding, and the use of recombinant inbred strains are described, and the ways in which these techniques have been used in areas relevant to pharmacogenetics are discussed. The power of the techniques lies in furnishing data necessary for a more complete description of the sources of variance contributing to the phenotypes being investigated (the genetic architecture of the trait in question). Although the groundwork has been laid for the use of all three techniques in pharmacogenetics, it is Broadhurst's contention that none of them has been employed to its fullest potential. More research using each technique is needed, and Broadhurst suggests ways of maximizing the information gained from future studies.

The monograph will be of considerable interest to researchers concerned with