any sex difference in visibility or reputation once quality and quantity of publications are controlled. To view this disappearance as confirmation that discrimination does not exist, however, assumes that women's inferior publication records do not themselves reflect discrimination. For if women publish fewer articles than men because, on the basis of their gender, they are denied access to the "means of production" in science—to research facilities, collaborative arrangements, graduate student assistants, professional sponsorships, secretarial help, or time off from teaching—then to find that the immediate cause of women's low status is their low publication rate hardly proves that the reward system of science is universalistic in any but the narrowest sense. Cole himself speculates that male faculty may be reluctant to sponsor female students because of the sexual motives colleagues might attribute to their doing so, but he apparently fails to recognize that such situations, in which women's careers are determined not by their scientific talent or performance but rather by the mere fact of their being female, are indeed a matter of discrimination. Thus, to argue that science is basically fair because women and men become equal once their publication records are taken into account makes no more sense than to argue from simple sex differences that discrimination clearly exists. To draw sound inferences, the cause of women's low publication rates must be understood.

Cole himself stresses that this is the single most important question for further research. Yet in this book he makes little attempt to marshall statistical materials on the causes of publication rates. (Qualitative materials are equally ignored.) A brief examination of a marital-cum-family-status classification and of type of academic employer (college vs. university) suggests that neither explains women's low productivity vis à vis men, but no attempt is made to measure such possible causes as professional isolation or failure to obtain research grants, even where data could have been found. For example, by counting single-authored and collaborative papers separately, rather than together as Cole does, one could ascertain whether men's superior publication counts derive largely from collaborative efforts, a pattern consistent with the hypothesis that women's professional isolation contributes to their low productivity. The more basic point, however, is that, unless there is clear evidence that discrimination does *not* play a role in women's low productivity, to explain any number of sex differences in professional status by the difference in publication rates is to beg the question. Cole's conclusion that discrimination plays no significant role in the careers of female scientists simply is not supported by his data.

This is especially true given the inability of research productivity to explain the paucity of women in the ranks of associate and full professor. Cole downplays this result by suggesting that women eventually "catch up" to men, a depiction that makes their failure to obtain the higher professorial ranks seem a temporary inconvenience. This view, however, is contradicted by Cole's own historical statistics, statistics that cover dates as recent as 1967 and that in all periods they cover show an *increase* in the gap between women's and men's academic ranks as their careers progress. It is also contradicted on several key points by another recently published study (*Climbing the Academic Ladder: Doctoral Women Scientists in Academe*, National Academy of Sciences, Washington, D.C., 1979). Cole acknowledges that academic rank has important consequences for scientists' careers; for example, rank partly determines academic salaries and may also influence access to the "means of scientific production." In addition, for the great majority of scientists who, as Cole notes, publish little and cannot even aspire to the greatest rewards their scientific community has to offer, gaining tenure or becoming a full professor may be among the most important achievements of their career. It is entirely arbitrary, then, to conclude as Cole does that "science" generally does not discriminate against its female practitioners because it discriminates against them in only one obvious way.

This book is thus a failure from the standpoint of substantiating its central conclusion. Is it nonetheless valuable because, for example, it provides new insight into women's scientific careers or suggests new strategies for overcoming the apparent liabilities female scientists suffer, whatever their cause? In my estimation, the answer is no. Some readers may of course find interesting or valuable material in the book, although the frequent recourse to regression statistics and sociological jargon is likely to deter many. For a social scientist familiar with the literature on sex inequality and on the sociology of science, however, the book is likely to prove more disappointing and tedious than insightful or stimulating. In reifying "science" and the "scientific community" from its subtitle onward, in failing to assess differences between fields or interpret differing statistical results for these fields, in largely ignoring biographies, women's letters to professional journals, and other qualitative sources, in failing to cite or incorporate results from recently published work bearing on its subject, and in repeatedly employing concepts that have been used elsewhere to characterize women's scientific careers but that are largely inappropriate to the data at hand, this book generally leaves the reader with a dry, superficial view of women's scientific careers. There are indeed important gaps in our understanding of women's careers in academic science, as this book helps make clear. It is therefore regrettable that it does not provide more substantial answers to the question why so many women in science have been unable to reap the recognition and rewards their male colleagues enjoy.

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The Ancient Oceans

Paleoceanography. THOMAS J. M. SCHOPF. Harvard University Press, Cambridge, Mass., 1980. xiv, 342 pp., illus. $25.

The science of oceanography is about 100 years old, if we take the global expedition of H.M.S. *Challenger* in the 1870's as its starting point. The science of paleoceanography is essentially a post–World War II development and is, in fact, only about 15 years old if we take the initial Phase I drilling of the JOIDES Deep Sea Drilling Project in 1965–1966 as the point at which modern studies of the deep-sea geologic record were initiated. And now in 1980 we have the first (to my knowledge) textbook in paleoceanography.

The book is based on a course in paleoceanography taught for the past ten years by the author. In a rather unorthodox approach Schopf divides the text into chapters on ocean volume, bathymetry, water studies, temperature, chemistry, climatology, and biology. An appendix (grain size nomenclature), references (over 900 of them), an index of names, and an index of subjects complete the book. Each chapter begins with an outline of the present-day pattern of the oceanographic feature in question, followed by an analysis of the methodology for delineating ancient corollaries or analogs of the feature and a concise summary of the history of the feature through geologic time.

In the opening chapter, on ocean volume, Schopf summarizes the evidence for the proposition that degassing occurred early in the earth's history (4.6 to 2.5 billion years ago) during rapid continental and oceanic evolution and was followed by slow recycling of the earth's crust and oceans. Factors governing changes in sea level are considered and an up-to-date, if somewhat less than comprehensive, summary of the seismic stratigraphic studies by Vail and others is given.

The various factors applicable to the interpretation of (paleo)bathymetry (such as grain size distribution, lithic, biologic, geochemical, and mineralogic criteria, backtracking, and carbon compensation depth) are discussed in chapter 2. Schopf takes note of the use of backtracking and the hypsometric curve in giving paleobathymetry a firm scientific base. The chapter concludes with an interesting analysis of two contrasting models for continental platforms: epeiric seas and marginal seas.

The chapter on water studies includes a discussion of tides, currents, and (particularly well treated, I thought) circulation. The chapter concludes with the observation that no aspect of paleoceanography has as promising or immediate a future as does the determination of ancient ocean circulation, an observation with which many of us working at oceanographic institutions and engaged in historical oceanographic studies can agree.

The chapter on temperature includes a consideration of the methods—geologic, biologic (taxonomic, faunal, and floral gradients and so on), and chemical (including isotopic)—used in determining ancient temperatures. Schopf discusses the effect of changes in the sun (solar constant) and atmosphere (increase in CO_2 and H_2O) in the past and succumbs to the temptation to link decrease in temperature with increase in magnetic field intensity. Whether such a link can be made is a controversial issue among paleoclimatologists and geophysicists, but the idea of the link appears to have been essentially discredited lately.

In the chapter on chemistry Schopf treats a variety of topics ranging from salinity and methods for assessing it in ancient deposits (involving measurement of boron, interstitial fluids and porosity, sedimentary phosphates, siderite, and so on) to ocean and atmospheric chemistry (including an analysis of the earliest ocean and atmosphere, the origin of oxygen, and banded iron formation). The general picture that emerges is of an essentially steady-state oceanic and atmospheric chemistry over the past 2 billion years following an early degassing of the earth's interior, an early equilibration with volatiles, and the development of an oxidizing environment.

In the chapter on climatology Schopf covers latitudinal zonation of climatic zones, patterns of sediment yield, and storms. Latitudinal control of shelf, slope, and oceanic sediment types is adequately treated, as are the influence of topography and climate on total river runoff and the rate of mechanical denudation. Storms are shown to be of great geologic significance as major agents of short-period sediment transport.

The final chapter, on biology, considers productivity, patterns of taxonomic change, and biogeography. Various explanations (such as sampling bias, increase in diversity within an adaptive zone, and changes in biogeography) are considered in accounting for observations about species diversity. Temperature per se is shown to have played an insignificant role in faunal extinctions. Rather, density-dependent changes (in temperature, salinity, and oxygen concentration, for example) are shown to provide the background against which important causes of extinction operate.

The treatment of biogeography is concerned with the prediction of faunal equilibrium and of the number and size of faunal provinces and with relating these predictions to observed changes in faunal diversity. Changes in the diversity of a faunal province are shown to be more likely to be a function of the number of provinces than of the size of the province. The role of ocean currents in determining the boundaries of faunal provinces is important, and thus species provinciality is seen as a function of the confinement of species by currents to given regions. The delineation of past faunal provinces will hinge on the ability of paleontologists to reconstruct ancient current systems. Schopf applies the concepts developed in the chapter to an analysis of changing biotic diversity through geologic time, in particular of the Permo-Triassic extinctions and of Silurian patterns.

Schopf has covered a large amount of ground in the book, and it should serve both as an excellent textbook for a graduate course in paleoceanography and as a source of reference for those working in the field. My main, and perhaps my only, criticism of the book is the lack of a sequential narrative dealing with the history of paleocirculation, paleobiogeography, and paleogeography insofar as they relate to a true historical geology of the oceans. This type of information is dispersed (and repeated) throughout the book, with the result that a sense of the historical continuity of paleoceanography is diluted. A final chapter might have provided a synthesis of this information. The interested reader can, in fact, find a narrative approach of this sort in the recently published *Climates throughout Geologic Time* by L. A. Frakes. The two books are perfect complements in providing an overview of the rapidly developing field of paleoceanography.

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Cetaceans

Behavior of Marine Animals. Current Perspectives in Research. Vol. 3, Cetaceans. HOWARD E. WINN and BORI L. OLLA, Eds. Plenum, New York, 1979. xxii, 438 pp., illus. $37.50.

To appreciate the constraints under which students of whale behavior labor other behaviorists might try spending some time restricted to observation of the tails of the animals they study. The popularity of studies of the acoustical behavior of whales is due to the fact that this is the one kind of behavior that can be observed with comparative ease and predictability. Knowledge of other aspects of their behavior often depends on incidental observations made in the course of studies concerned with other matters or on inference from other factors.

The editors of the present volume acknowledge the difficulties of studying whale behavior and yet go bravely to the task. The papers in the volume fall into three general categories: accounts of methodologies, natural histories, and reports of work on vocalization.

The methodological papers include a good review by S. Leatherwood and W. E. Evans of radio tagging and tracking efforts. Successful radio tracking of most species appears possible, but there are no "off the shelf" systems available. Early results of efforts to identify individual humpback whales by means of fluke photographs, reported by S. Katona *et al.*, indicate that this method may be used for studying migration and social relationships in this species.

Natural history papers on the northern right whale dolphin by Leatherwood and W. A. Walker, Dall's porpoise by G. V. Morejohn, and the bottle-nosed whale by T. Benjaminsen and I. Christensen are good contributions to understanding of