Mass Extinctions: Processes And Evidence

eralizations in a time and place, as do the numerous illustrations she (and her publisher) have included. You come away from this book with a good sense of the changing atmosphere of the office, the personalities of the organizers, and the feelings of those who fought against bureaucratization—and lost.

Yates is firmly on the side of this important aspect of modernization, that is, the achievement of greater efficiency through standardization and tighter control. In that sense, she adopts the values of those business leaders who led the drive for business combination, centralization of control, and administrative consolidation, major themes in U.S. business between the 1880s and 1930s. She might, I think, have given more thought to how innovation fitted into the movement for centralization. She hints at a relationship in her treatment of communications at DuPont's research and development organization, but the theme calls for more elaborate development. The controls she describes were well suited to top-down innovation in a setting characterized by adversarial labor relations and standardized operations. The controls improved efficiency by making the people involved replaceable parts in a tightly controlled bureaucratic system. They did not encourage process or product innovations on the shop floor. In effect, business traded that sort of bottom-up innovation for the immediate gains to be realized through systematic management, American style. Eventually U.S. business would pay a big price for adversarial labor relations and the style of innovation it sustained. There was thus a downside to centralization to which Yates might have given more consideration in light of her concern with using "historical events" to "illuminate current problems and issues" (p. 275).

There is little else to complain about in this solidly researched and carefully reasoned account. Yates sets her study firmly in a broad context stressing (à la Alfred D. Chandler) the growth of large enterprise and modern management. She thus avoids the kind of intellectual fragmentation that has taken place in the bottom-up style of social and political history. Throughout, she helps her readers by carefully defining the terms she uses. She distinguishes between so-called "scientific" and "systematic" management, wisely stressing the latter and much broader movement. She shows us precisely how business developed an "organizational memory" and when businessmen learned to use it effectively to manage. As they did so, depersonalization and alienation became problems, and Yates discusses these negative dimensions of the drive to replace ad hoc with systematic controls. Some firms responded with in-house magazines trying, one editor explained, to "humanize our magazine with concentrated personality" (p. 75). We will never know what "concentrated personality" actually achieved, but we are very much in Yates's debt for showing us how these tensions developed and how firms tried to deal with them.

Products of size, complexity, and technical change, these problems as well as the modes of control that helped create them were essential aspects of the process of bureaucratization that has transformed modern society. Some lament it. They will sympathize with General Henry DuPont, who stoutly refused to let a newfangled typewriter into his office. Others applaud the new age. They will sympathize with Pierre S. DuPont, the Apostle of System. Whether we like or detest it, we all experience the managerial society every day of our lives. We should be grateful to Yates for describing and analyzing a crucial phase in the emergence of that society, for establishing the importance of leadership in bringing these changes about, and for assuring us that the new controls were not simply an inevitable consequence of technological forces over which mortals had no control.

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Post-Origin Paleontology

Mass Extinctions. Processes and Evidence. STEPHEN K. DONOVAN, Ed. Columbia University Press, New York, 1989. xiv, 266 pp., illus. $45.

Long before Brazilians with buzz saws, a student of taxonomic death could have observed clams suffocating in anoxic waters, ferns freezing from climatic change, or perhaps even dinosaurs vaporized by meteorites. *Mass Extinctions: Processes and Evidence* is the most recent addition to an already sizable number of books on such past extinctions. Most of these books are either loosely organized symposium volumes or single-authored books presenting personalized views. Donovan's goal in this book is to do what these other books do not: provide a primary reference work that coherently summarizes the growing literature. In my opinion, he has succeeded.

The 12 chapters in this book are generally well-written overviews by specialists in each subject. The first three are devoted to general considerations, comprising a historical perspective of mass extinction studies (Hoffman) and explications of the key role of paleontology in mass extinction studies (Donovan) and of the geochemistry of bio-event horizons (Orth). The next nine chapters are summaries of current knowledge of nine major extinction events. These include the "big five," ending the Ordovician, Devonian, Permian, Triassic, and Cretaceous periods, as well as extinctions toward the end of the Precambrian, Cambrian, Eocene, and Pleistocene.

Though each chapter is generally interesting and informative in its own right, some important impressions emerge from the collective whole. One is the sheer quantity of data on these past events. An impressive array of stratigraphic, paleontological, geochemical, and many other lines of evidence is displayed as each author attempts to reconstruct the biotic and abiotic events that occurred. Another impression has to do with what is inferred from all these data. In eight of the nine extinctions, climatic or sea-level change is implicated as a major causal perturbation. Only the end-Cretaceous (K-T) event, for which Upchurch concludes that a bolide impact is most harmonious with the data, differs. Yet even here there is evidence that long-term climatic change was also involved.

To the well-versed reader, there is a good deal of *déjà vu* here. Any good historical geology textbook of 1960s vintage can be found to contain basically the same ideas concerning the causes of most of these events. Obviously, there has been much necessary refinement of the data, but are we mainly learning more and more about less and less? Judging from this book, the answer is no, because the most important impression of all is how most authors go beyond a simple laundry list of what died, when, and what abiotic process pulled the trigger. They broach what may well be the next phase of mass extinction research: increased analysis of the role of biotic properties and biotic dynamics in extinctions. For too long, "explanations" of mass extinctions have focused on identifying abiotic "perturbations" (either single or coincidental). True enough, in some catastrophes such explanations are about all there is: if a massive bolide erases all life and landscape in a wide area, knowledge of the abiotic input just about says it all. In most cases, however, especially where habitats are altered gradually, the causal chain to extinction will include many biotic variables. Crucial among such variables are biotic properties that cause some groups to go extinct while others do not (selectivity) and biotic interactions that are themselves the cause of extinction (secondary extinctions caused by previous abiotic deletions of species, or extinctions via species additions).

Fully six of the nine extinction-event chapters discuss selectivity and which biotic properties favored survival. McGhee (Devo-

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