Escalators to glory

Simon Conway Morris

Evolutionary Trends. Edited by Kenneth J. McNamara. *Belhaven: 1990. Pp. 368. £45.00. University of Arizona Press, $24.95.*

THE history of life has been described as a shimmering tapestry. Just as many of the most interesting patterns in a tapestry become clear when viewed across the room, so perhaps some of the patterns of evolution can only be seen through palaeontological spectacles. With so many evolutionary trends part of our folklore, it is a brave editor who summons the evolutionary hierarchs. That McNamara has been largely, if not quite, successful will be apparent not only from the range of expertise (indeed one feels the authors will learn as much from each other as any reader), but more significantly because the reiteration of common themes makes this book an unexpected treasure-trove for the biologically curious.

One major question is what relationship lies between the generation of trends and environmental factors. In the case of marine bivalves (documented by Miller), it appears that it is the environment in which these creatures find themselves, rather than net changes, that drive the evolutionary trend. In a related vein McNamara illustrates how evolutionary trends in infaunal echinoids arise by progressive invasion of fine-grained sediments, often in deeper water. Discussing mammals, however, Janis and Damuth are even more committed to the role of the environment, writing that "more or less unidirectional climatic change . . . has driven much of mammalian evolution and diversification". Others are more muted. For example, Dommergues writing on ammonites finds no clear connection between "morphological change and possible environmental constraints".

The trends themselves may fall fairly and squarely into macroevolutionary patterns, but what of the processes? Here this book is somewhat indecisive. Gould's opening chapter is cast into a thoroughgoing macroevolutionary framework, but elsewhere the issues are evaded. There are some perfunctory nods to punctuated equilibria, but more effort is expended by several authors in balancing processes involved with anagenesis and cladogenesis. A more constant theme is the role of heterochrony. If Gould put heterochrony back on the map, then it is largely thanks to McNamara that we have a recognizable geography. Scarcely a chapter fails to invoke some sort of heterochrony, but as to actual mechanisms that change timing of development we are largely ignorant. But even if pattern rather than process is understood, proper comprehension of evolutionary trends allows sensible projection into the future. So on the last page McNamara unfolds the likely history of a group of infaunal echinoids. Readers of *Nature* in a mere two million years will be raiding their library stacks to check this prediction.

It is generally accepted that metazoans occupy only a small portion of the potentially available morphospace (however defined). A major pre-occupation of this book is their trajectories through time. Cited by almost all the contributors is Gould's observation that in many cases trends are a result of no more than changes in variance through time. But also relevant is how trends are constrained. One aspect relates to the boundaries (or reflectors) of morphological possibility. This is explored by McKinney who adopts a nomothetic approach, with emphasis on serial correlation of trends. The topic is touched on by others, principally by Miller in his discussion of on-shore-off-shore trends.

Morphological trajectories presuppose a destination, and a striking aspect of this volume is the emphasis on convergence. So commonplace is this evolutionary phenomenon that comment might seem superfluous. This would be a mistake, and the reiterated examples of convergence in groups such as mammals (Janis and Damuth), ammonites (Dommergues), bivalves (Miller) or echinoids (McNamara) show that any discussion of trends must involve analysis of why the clouds of morphology so often condense at the same spots. This is no trivial observation, because it undermines those who suppose that if life's tapestry was unwound and rewoven the pattern would be very different.

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Crystals on the map

Moreton Moore

Historical Atlas of Crystallography. Edited by J. Lima-de-Faria. *Kluwer: 1990. Pp. 158. Dfl 69, £20, $20.*

"HE who sees things grow from the beginning will have the best view of them" (Aristotle).

Crystallography has been an international science from the earliest times. The atlas contains some maps of Europe to show where the principal crystallographers worked in the sixteenth to the nineteenth centuries as well as a map of the world to include twentieth-century pioneers from North America, India and Japan. This is also a historical atlas in which the coordinate of time is represented on a linear scale and important events marked in their correct positions on such "time maps". Thus one can see at a glance when the periods of greatest achievement took place, in a graphic and memorable display which will appeal to practitioners of this visual science. The drama is brought alive by portraits of the "actors" and by reproductions of the title pages of their early works.

The four main branches of crystallography — geometrical, physical, chemical and crystal structure determination — are each treated historically in the chapters which follow. Probably the first textbook on mineralogy was *De Natura Fossilium* by Agricola (alias Georg Bauer), published in Basel in 1546. In Copenhagen in 1669, the first important experimental discovery in crystallography was made by Bartholinus (Bartholin) when he observed the double refraction of light

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Crystallography triumphant — X-ray diffraction image of DNA.