

ceiving. The first naturalistic drawing of the Moon in Western culture by Jan Van Eyck dates from around 1420. Why so late? asks Montgomery, who proceeds to show that it was only when astronomers started looking at the Moon as another Earth that they began seeing it for what it really is. Whereas Thomas Harriot, the first person to produce an image of the Moon on the basis of telescopic observations in 1609, saw only "a strange spottedness all over", Galileo saw mountains and valleys and a huge circular crater that he compared in size and shape to Bohemia.

Galileo looked at the Moon with the eye of a cartographer. His map was a kind of visual experiment, a way of 'demonstrating' that the bright spots on the Moon's surface were tips of mountains, and the curiously shaped shadows were deep valleys. The science of optics and the art of map-making could achieve little alone. It was their combination that opened a new era of investigation. Mapping the Moon became a rigorous science as well as a political act; astronomers and their patrons tried to make the Moon their own by naming its features. Modern scientists are less prone to plant flags on virgin soil but they can be very keen about patents.

Montgomery offers a survey of the field of scientific illustrations and the ways in which they have been read, not only in terms of their iconography and pictorial effect, but also as embodiments of changing ideologies and shifting epistemologies. This 'rhetoric' of imagery is fraught with internal contradictions, competing messages and the chance that the visual representation may be perceived in new ways not intended by its maker.

Images in scientific journals are always undergoing some kind of extension and innovation, and there is often a tension between text and illustration. Two universes of readerly experience are sometimes laid side by side. One is weighed down by jargon and flatness in writing, while the other grows more colourful and appealing year by year. The visual material is getting so good that it tends to be there for aesthetic rather than illustrative purposes. No word is innocent. The same can be said of illustrations.

Montgomery combines sound scholarship with a sense of humour, which occasionally becomes a sense of urgency when experiments with language get out of hand and acquire a canonical status they do not deserve. This book will be read with enjoyment by all those who suspect that the truths of the present are often the metaphors of the past. □

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Dinosaurs for grown-ups

Alan Charig

The Evolution and Extinction of the Dinosaurs. By David E. Fastovsky and David B. Weishampel. *Cambridge University Press: 1996. Pp. 460. £29.95, \$44.95.*

UNDERGRADUATE courses on dinosaurology are now common in North America. This book is intended mainly as a textbook for these courses, but it serves also to bring specialists up to date. It provides a readable account of nearly every aspect of dinosaurs. There is, however, little descriptive anatomy; that subject is already well covered by *The Dinosauria* edited by D. B. Weishampel, P. Dodson and H. Osmólska (University of California Press, 1990).

Most aspects of dinosaurs are beset with controversy (for example, origins, bipedality, phylogeny, endothermy, origin of birds and extinction); this is what makes them so fascinating. An excellent feature of the new book is its airing of alternative views, usually explained without bias, although the authors themselves often plump for one or the other. Unfortunately, however, these views are sometimes put forward without attribution to their original proposers or without bibliographical reference. Similarly, other authors' figures are sometimes copied without acknowledgement.

The book is divided into four parts. The five chapters in the first part cover taphonomy, collecting and preparation; stratigraphy and chronology, plate tectonics and palaeoclimatology; hierarchy and evolution; the interrelationships of all life forms (with the emphasis on the chordates); and the origin of the dinosaurs. The five chapters in the second part deal with the various groups of Ornithischia (unusual, to do them first); each chapter is organized into a history of discoveries, definition and diagnosis, diversity and phylogeny and, finally, palaeoecology and palaeobiology. The third part (three chapters) is concerned, in rather less detail, with the Saurischia and the origin of birds, whereas the fourth part (four chapters) covers endothermy, distribution in space and time, and extinction. The text includes 20 boxes and several footnotes on incidental topics. "Important readings" are given at the end of each chapter, but there are not

nearly enough. An excellent glossary at the back is followed by three separate indexes: for subjects, genera and authors. A few anecdotes, poems and cartoons provide light relief; and the writing style, although a little too informal for me, is thoughtful and interesting and will probably please student readers.

The black-and-white illustrations include photographs, drawings (somewhat stylized), graphs, charts, tables and maps. Fourteen colour paintings by Brian Regal are placed together near the end; they are no doubt accurate, but again very stylized and (to my eye) devoid of charm.

The authors employ a purely cladistic approach to phylogeny reconstruction and classification, without hierarchical ranks in the latter; they explain cladistics using non-biological analogies, classifying motor vehicles and wrist-watches accordingly. But there is virtually no mention of ancillary methods of phylogeny reconstruction, such as stratigraphical chronology, embryology and ontogeny and, best of all, transformation series; nor is there any suggestion that synapomorphies (homologous characters) should be chosen critically. Like all cladists, the authors eschew stem-groups and other paraphyletic taxa. But as all these cannot be avoided in discussion, they are disguised in various ways: *Thecodontia* as *basal archosaurs* or simply '*Thecodontia*', *Prosauropoda* as *basal sauropodomorphs*, and *dinosaurs* in the usual sense as *non-avian dinosaurs* (although, in fact, the



TERTIARY amphibians, as depicted in *Life Before Man* by Z. V. Špinar. This classic book, first published in 1972, inspired a whole generation of palaeontologists with its evocative sequence of colour illustrations by Zdeněk Burian. Many new ones appear in the revised and updated paperback edition, which now covers recent discoveries of fossil fishes, amphibians and reptiles and the latest theories about the origins and early development of mammals and humans. Thames and Hudson, £9.95.