BOOK REVIEWS

KLEIN, N., REMES, K., GEE, C. T. & SANDER, P. M. 2011. *Biology of the Sauropod Dinosaurs: Understanding the Life of Giants*. xii + 331 pp. Indiana University Press. £40.00, US$59.95 (HB). ISBN 9780253355089. doi:10.1017/S0016756811001166

Sauropod dinosaurs represent some of the most bizarre animals to have ever existed. Their enormous body weights, of up to 70 tonnes, suggest that they were pushing at the physiological and structural limits of what the vertebrate *Bauplan* could allow. These limits have been the subject of an intensive research programme over the past few years, conducted by a German-based research unit under the leadership of Prof. Martin Sander (University of Bonn). This research group has been funded by several successive grants from the Deutsche Forschungsgemeinschaft (DFG), a remarkable achievement for pure curiosity-driven research: it is sadly inconceivable that UK-based research councils would be visionary enough to countenance funding such a blue-skies project with no obvious alignment to perceived societal or industrial 'value'. Sander assembled a team of around 40 colleagues to address issues related to sauropod gigantism, drawing on experts with backgrounds in palaeobotany and the physiology and biomechanics of living animals, as well as vertebrate palaeontologists, in order to attempt a comprehensive understanding of the factors promoting large body size in sauropods. This volume, together with what will become a benchmark review paper (Sander *et al*. 2011), is the major output of the project (along with the numerous specialist journal papers already published and in gestation).

The volume is divided into four sections of several chapters each, book-ended by an Introduction and Epilogue. Each section deals with a different topic: nutrition, physiology, structure and growth. Although I have numerous individual disagreements with some of the detailed conclusions presented therein, this nevertheless represents a valuable addition to the literature on these animals as it contains many novel ideas and quite a bit of new data. It will definitely instigate more work on sauropod biology and help to focus future work in new directions. In some cases, however, the chapters contain substantial reviews of the other peer-reviewed papers already published by the research unit, which seems a bit superfluous, given their recent publication. I particularly enjoyed the chapters by Hummel and Clauss on sauropod feeding and that by Sander *et al.* on bone histology. Many topics are addressed, ranging from the use of finite element analysis in understanding sauropod structural performance, to thoughts on sauropod lung structure and respiratory physiology.

My major criticism of this volume is that almost all discussion of sauropod evolution (in terms of the development and elaboration of the organ systems discussed) proceeds in a phylogenetic vacuum. Only a couple of the chapters attempt to investigate functional morphology/physiology within an explicit phylogenetic context, although excellent sauropod phylogenies are available in the literature. This omission (and the surprising absence of any original phylogenetic work under the auspices of the project) probably results from an aspect of the long-standing German tradition of *Konstruction-Morphologie*, whereby organisms are assumed to evolve in response to biomechanical and architectural constraints, and the trajectory of this evolution can be determined without the need to include the taxa under consideration in genealogical analyses. Absence of a rigorous evolutionary context reduces the utility of the work overall, however, as it is not always clear when some of the adaptations for large body size appeared, nor how these functional complexes might have evolved in a step-like fashion. Moreover, almost all of the work of the unit involves investigation of how to maintain or reach a large body size: there is almost nothing on the factors that might have led to the initial acquisition of large body size in the sauropodomorph lineage, which represents a missed opportunity given the funding and expertise available.

Nevertheless, *Biology of the Sauropod Dinosaurs* is welcome on my bookshelf. It is full of new hypotheses and will enliven debates on sauropods for many years to come. Its publication is evidence of the strong resurgence of interest in these animals that, until recently, was largely overshadowed by work on the ferocious, feathered and flying members of the dinosaur family tree.

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Reference

SANDER, P. M. *et al.* 2011. Biology of the sauropod dinosaurs: the evolution of gigantism. *Biological Reviews* **86**, 117–55.

LOWRIE, W. 2011. *A Student's Guide to Geophysical Equations*. xiv + 281 p. Cambridge University Press. Price £50.00, US$80.00 (HB); £19.99, US$29.99 (PB). ISBN 9781107005846 (HB); 9780521183772 (PB). doi:10.1017/S0016756812000143

Lowrie's book is essentially a geophysicist's 'guidebook' of solutions to the 'classic' problems in solid earth geophysics. The book presents step-by-step derivations of the most important governing equations that geophysicists use to describe the physics of the Earth. Many of the solutions presented were first realized in previous centuries by the type of great geophysicists for whom parameters are named. The topics covered include gravitation and gravity (including Earth's figure and geoid), the tides, Earth's rotation, Earth's heat, geomagnetism, and the fundamentals of seismology. Solutions are presented in a clear and thorough manner, starting from first principles.

Lowrie's book serves as a basic resource for anyone who needs to revisit the basic theory of classical geophysics. Students of geophysics – primarily advanced undergraduates and graduate students – will clearly benefit, because this book provides derivations for the governing equations that are often presented alone in more standard textbooks. In fact, Lowrie wrote a prominent geophysics textbook *Fundamentals of Geophysics* (Lowrie, 2007) that covers the same basic topics using a different, and yet complementary, approach. While the *Fundamentals* textbook discusses the geological ramifications and historical context of the geophysical equations, this *Equations* guidebook largely replaces this narrative in favour of full derivations. Thus, students who want to expand upon these solutions, who use numerical codes that are based on them, or who simply want to know how to obtain them, will find *Geophysical Equations* extremely useful. Although it possible to compile these derivations from original sources, more advanced texts, or others' lecture notes, anyone who has attempted this (for example, in the preparation of lecture notes) soon finds that clear and concise solutions can be difficult to assemble from readily available sources. This book makes this significantly easier, and thus will find an audience from instructors as well as the students referenced in its title. I wish this book had been available when I was preparing my own set of geophysics lecture notes!

Each solution starts with a brief discussion of the basic physics of a problem and an outline of the first principles needed to solve it. Even the relevant mathematical background is included (vector calculus and linear algebra; there is even a nice discussion of spherical harmonics). This introduction is followed, in a self-contained way, by all the steps and diagrams needed to obtain the important geophysical equations. Note that many 'applications' of these geophysical equations are left untreated. Thus, many geodynamics problems such as plate rotations on a sphere, viscous convection, postglacial rebound, and elastic plate bending, are omitted despite the fact that the continuum mechanics framework needed to solve these problems is already developed to introduce seismology. Nevertheless, the 'fundamental' geophysical equations are presented here in an informative and intuitive way, which makes this relatively inexpensive book an excellent investment for any geophysicist's library.

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Reference

LOWRIE, W. 2007. *Fundamentals of Geophysics*, 2nd edition. Cambridge University Press, 392 pp.

TALENT, J. (ed.) 2012. *Earth and Life: Global Diversity, Extinction Intervals and Biogeographic Perturbations Through Time*. xxviii + 1100 pp. Springer. Price £90.00, US$129.00 (HB). ISBN 9789048134274.
doi:10.1017/S0016756812000489

This huge volume was published as part of the UNESCO International Year of Planet Earth (IYPE) scientific programme, a joint initiative of UNESCO and the International Union of Geosciences. The core year for the IYPE was initially 2008, but grew to 2007–2009. Volumes already published in the series are Geophysical Hazards (2009), New Frontiers in Integrated Solid Earth Sciences (2009), and Medical Geology (2009), and it appears that other volumes are to be released in 2012. The present volume is said to be aimed at Earth Science professionals and students.

The text in the nicely finished, extremely weighty hardback volume is in two columns, each page being 190 × 260 mm; the volume is lavishly sprinkled with colour illustrations. There are six parts to this tome: general articles (9 contributions); evolution exemplified by specific phyla or classes (9); global extinction events and biocrises (9); palaeogeography (5); Cenozoic era (3); and an editorial epilogue.

Perhaps the first step is to assess broadly how the volume has met the stated aims. At the mega-level, the IYPE programme hopes to 'go some way toward helping to establish an improved equilibrium between human society and its home planet'. In his preface to the volume John Talent says 'The volume was directed towards considering the broad pattern of increasing biodiversity through time, and recurrent events of minor and major ecosphere re-organisation . . .'; in other words, to scrutinise life crises throughout geologic time.

Seventy four authors contributed to 36 papers. With all due respect to the skilled editor and his cast of stars, given the vast number of taxonomic groups, one volume cannot hope to cover every last group, event, crisis or extinction. So what do we get? We find a volume packed with information and interpretation, large and small papers, with a heavy emphasis on invertebrates (my count is: invertebrates [25], vertebrates [8], plants and fungi [2]). To me it seems that the first four papers in the general section are those which best address fundamental questions of biodiversity (Aberhan & Kiessling; Brett); astronomical phenomena (Lieberman & Melott); and climate (Dodson). Most other papers focus on individual taxonomic groups, time intervals, events or particular environments. A most spectacularly illustrated and substantial paper (Jun-Juan Chen, pp. 239–379), with its main focus on South China, discusses the early history of the animal kingdom, including early 'vertebrates' from the Maotianshan biota. For me, another valuable contribution is that by Black *et al*. (pp. 983–1078) on 'The rise of Australian marsupials: a synopsis of biostratigraphic, phylogenetic, palaeoecologic and palaeobiogeographic understanding'.

Assessment of the other contributions is hardly a feasible option, given the wide range of subject material. There is a huge wealth of important material in the volume, which is a must for Earth Science libraries.

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MISRA, K. C. 2012. *Introduction to Geochemistry*. xiv + 438 pp. Wiley-Blackwell. Price £85.00, €102.00, US$149.95 (HB); £37.50, €45.00, US$89.00 (PB). ISBN 9781444350951 (HB); 9781405121422 (PB).
doi:10.1017/S0016756812000519

In the early parts of the book, the basic chemistry required in geochemistry is reviewed: units of measurement; atomic structure; the nature of chemical bonding. This is both thorough and lucid and also explains some of the historical context to the development of these ideas. This continues in Part II of the book with an introduction to thermodynamic concepts, followed by chapters on the thermodynamics of solutions, geothemometry and geobarometry, aqueous solutions, redox reactions and chemical kinetics.

Applications of radiogenic and stable isotopes are covered in two chapters that comprise the third section of the book. These chapters provide a thorough treatment of the theoretical basis of radioactive decay and isotope fractionation and cover key applications in the geosciences. The stable isotope chapter contains material that is very up-to-date. For example, it includes Fe isotopes and mass independent fractionation of S isotopes, but surprisingly little on carbon isotopes.

The final section 'The Earth Supersystem' deals with the evolution of the earth. The first of two chapters in this section deals with the solid earth, from its beginnings in nucleosynthetic processes and accretion and through geological history. The second chapter deals with the hydrosphere