like *Rosetta* and *Hayabusa*, in progress or, like *Stardust*, have delivered material back to Earth.

In the first chapter, Oró, Lazcano & Ehrenfreund provide an historical background, and pose the question central to the book: 'Did comets play a role in the origin and early evolution of life on Earth?'. Varying views from the fifteen authors of the further eleven chapters follow, and definitive answers are just as elusive as they were a decade ago. While there is general agreement that comets delivered prebiotic organic materials and water to the early Earth, it now seems possible that the Earth's early organic inventory included both 'external' organics, and 'internal' organics synthesized in the atmosphere, or in the oceans. And while comets may have played a vital role in the origin of life, conversely they may also have been inimical to its development.

In Chapter 2, Delsemme addresses the complex problem of the origin of the Earth's atmosphere and oceans into which prebiotic organics were introduced. Maurette (Chapter 3) also reviews the evolution of the atmosphere, and considers the role of dust (micrometeorites) as probable cometary material delivered to the Earth. Advances in the remote search for organic macromolecules in comets, star-forming regions, and interstellar clouds is the subject of Chapter 4 by Huebner & Snyder. Greater computational power has allowed more accurate simulations of cometary impact, and Pierazzo & Chyba (Chapter 5) compare and contrast models of survivability of prebiotic organic matter during impact delivery to the Earth, Mars, the Moon, and Europa. In Chapter 6, Chyba & Hand consider the delivery of organics in the broader context of the Late Heavy Bombardment by comets 3.9 Ga ago.

The next three chapters by Zahnle & Sleep, Glikson, and Morrison, respectively, focus on the role of cometary impact in the destruction of life. They suggest that the sterilizing effects of giant impacts may have posed a severe challenge to the survival of early life on Earth. Glikson (Chapter 8) presents some tentative supporting evidence for this from 3.8–2.4 Ga rock sequences in the Pilbara (Western Australia) and the Kaapval (South Africa) cratons, while Morrison (Chapter 9) assesses the threat of cometary impacts with the Earth. In Chapter 10, Podolak & Prialnik model the conditions where liquid water, fundamental to life, may be released in comets.

Embodied in this volume is much of the current knowledge on the constitution of comets. Sadly, due to publication timing, while remote cometary observations from space missions are included (Kissel & Kreuger, Chapter 11; Kreuger & Kissel, Chapter 12), the early results from the study of the material returned to Earth from Comet Wild 2 by *Stardust* are not. Moreover, although data from carbonaceous chondrites are sprinkled throughout the book, there is no extended treatment of the work by organic chemists on these primitive Solar System materials as possible proxies for cometary material. Nevertheless, I highly recommend the book to all involved in Earth and Planetary sciences, and the text, which is clearly written and illustrated, is also accessible to a much wider readership.

Alex Bevan

CATUNEANU, O. 2006. *Principles of Sequence Stratigraphy*. ix + 375 pp. Amsterdam, Boston, Heidelberg: Elsevier. Price Euro 80.00, £55.00, US $86.95 (hard covers). ISBN 0 444 51568 2.
doi:10.1017/S0016756807003627

After a contentious and often turbulent start, sequence stratigraphy is now widely accepted as an additional tool in the kit of sedimentary geologists striving to interpret the record of sediments and sedimentary rocks. Elements of what we now understand as sequence stratigraphy had been rumbling along in the background for some time before the explosion that started to appear in the scientific literature in the late 1970s. It is easy, with the benefit of hindsight, to find key elements of the concepts in papers published during the 1950s and 1960s but we had to wait until the 1970s for these elements to be organized into a coherent framework. That this phase took place largely within the confines of a commercial company (Exxon) using seismic and related data that were far from being in the public domain imparts a very distinctive character to the development of the concepts. Much of the early criticism of sequence stratigraphy relates to this point. Some also erroneously saw sequence stratigraphy as an attempt to replace existing, established approaches. In fact it is a complement to these approaches and by reviving the importance of time in relation to sedimentation, sequence stratigraphy reinstated the link between sedimentology and biostratigraphy. This is perhaps best exemplified by the revival of chronostratigraphic charts (or Wheeler diagrams) that did not feature during the era of facies analysis. As a student of the facies analysis era I find my ignorance of Wheeler diagrams at that time as nothing short of criminal, but I was not alone.

There was perhaps a further reason why the concepts were initially given such a hostile reception. In the early key publications of sequence stratigraphy models such as the global sea level curve and the passive margin 'slug' were emphasized at the expense of the methods that had been used to develop the models. It took many people time to look beyond the models and see that there were novel methods embedded in seismic and sequence stratigraphy that could be used without devotion to the models. The principal strength of Catuneanu's book is that it sets out to explain the methodology of sequence stratigraphy as applied to surface and sub-surface data rather than focussing on the models. This tactic is clearly stated in the Preface and is executed throughout the text. As a practical, pragmatic statement of sequence stratigraphy, Catuneanu's text stands apart from competitor texts in an extremely positive way.

Following a short Introduction, the book reviews the Methods of Sequence Stratigraphic Analysis as applied to surface exposures, core, well logs and seismic data (Chapter 2). The concept of Accommodation is then reviewed, particularly as applied to shoreline behaviour (Chapter 3). The nature of Stratigraphic (or Key) Surfaces is then explored (Chapter 4), setting up the subsequent chapters (5, 6) on Systems Tracts and Sequence Models. The latter chapter discusses sequences in fluvial, clastic coastal/shallow marine, clastic deep-water and carbonate depositional settings. The book concludes with a discussion of Time Attributes of Stratigraphic Surfaces (Chapter 7) and the Hierarchy of Sequences and Sequence Boundaries (Chapter 8). The organization of the book is logical in the main, but I would have preferred to see the chapter on Time Attributes of Stratigraphic Surfaces (Chapter 7) linked to the earlier chapter on Stratigraphic Surfaces (Chapter 4). The text is well written and is richly illustrated with high quality, colour diagrams and photographs that are comprehensively explained in extended figure captions, imparting a 'stand-alone' feel to the illustrations.

The account of sequence stratigraphic approaches and methods steers a sensible course through the issues and terminology that dogged the early days of sequence stratigraphy. The basic principles of sequence stratigraphy and the usage

of outcrop, core, well log and seismic data in this context are covered comprehensively and clearly in the early chapters and there is a short, but very useful, section describing a workflow for sequence stratigraphic analysis. The treatment of up-dip, coastal sedimentation and stratigraphy is exemplary in its clarity and depth of coverage. This is the depositional sector where many of the principles of sequence stratigraphy were established and besides being important in its own right this sector it is also crucial in terms of potential sediment supply farther down-dip.

The text covering deeper water settings discusses shelf-edge deltas in the context of sediment delivery to deep water settings, but the nature of slopes, specifically topographically complex slopes influenced by salt- and/or mud-deformation, receive scant attention which is unfortunate in view of the importance of the slope in current hydrocarbon exploration. The text also deviates from its pragmatic emphasis and becomes rather idealized and model-driven in this section. The account of deep water sequences is organized around an idealized sequence. Condensed sections are naturally used to define the sequence, but their lithology and sub-surface expression, briefly discussed in Chapter 4, are under-reported here. The account of deep water depositional elements returns the reader to the pragmatic theme of the book and is well illustrated by seismic cross-section and map views of the elements. The application of sequence stratigraphy to carbonate settings is discussed largely with respect to shelf type platforms. This approach highlights essential differences in the response of carbonate and siliciclastic settings to base level changes that stem largely from contrasts in sediment supply (in situ production versus external delivery) and bathymetry.

This book covers basic principles yet manages to reach a research level in a commendably concise manner. The focus on pragmatism is key to this text surpassing all of its rivals as a comprehensive and advanced introduction to the subject of sequence stratigraphy. It deserves to be used selectively as an entry level to the subject, and comprehensively by those in academic, industrial and survey settings who aim to unravel the stratigraphic record and predict facies distributions.

Trevor Elliott

MÄRSS, T. WILSON, M. V. H. & THORSTEINSSON, R. 2006. *Silurian and Lower Devonian thelodonts and putative chondrichthyans from the Canadian Artic Archipelago*. Special Papers in Palaeontology no. 75. 144 pp. London: The Palaeontological Association. Price £54.00 (paperback). ISBN 0 901702 99 4; ISSN 0038-6804. doi:10.1017/S0016756807003615

As one of the reviewers of the original manuscript I early declared my interest in this work, and indirectly I also had the opportunity to guide and support the progress of getting it published. Therefore, it comes rather naturally to say that I am pleased to see this work published after all the effort I know was put into it, not forgetting the great scientific value it provides.

Thelodonts, which are the main focus of this work, are an ensemble of fossil jawless vertebrates distinguished from other jawless vertebrates by the organization of their exoskeleton which is entirely made up by minute scales that resemble the placoid scales of sharks. Most studies on thelodonts have been based on isolated scales only, but more recent studies on articulated thelodonts have shown that simple scale taxonomy can be misleading because of the wide range of scale morphologies that can occur in the same individual. Some scientists, including the authors of this monograph, have instead used articulated specimens to establish a more stable taxonomic approach, and have provided a model for how a set of scales in a 'microvertebrate' assemblage can be used to recognize taxa that better represent a species. This approach, obviously, gives a more accurate account for taxonomic diversity. However, articulated specimens are rare and the difficulties in understanding the fossil record have hampered accurate estimations of general diversity and potential radiation events, despite the fact that isolated scales of thelodonts for a long time have been regarded as very useful tools in biostratigraphy.

The present monograph, which is primarily a taxonomic study, provides a large amount of new data based on material yielding 39 thelodont species from the Canadian Arctic Archipelago, of which 12 are based on articulated material. Using this new information, Märss and her co-authors have been able to revise thelodont systematics and minimized many of the taxonomic problems that have followed this research for some years.

The accumulated knowledge from previous work in general and this work in particular shows that both taxonomic and morphological diversity of thelodonts is much greater than previously believed. This new information can and will be used both in a phylogenetic context and greatly to improve biostratigraphical resolution.

Beside its systematic value, this well illustrated volume clearly demonstrates, using the articulated material, the morphological variability of scales in one individual and how that can be used for 'microvertebrate' assemblages. In this context, this monograph is also of educational value and interest for a broader readership of geologist, palaeobiologists and students, and not only the more obvious readers such as specialists on early fishes and biostratigraphy. It is however likely that the price of this volume (£54.00 paperback) will prevent the general category of readers from exploring this book for educational purposes, but for us specialists this is a much valued contribution.

Henning Blom

KNIGHT, P. G. (ed.) 2006. *Glacier Science and Environmental Change*. xiv + 527 pp. Oxford: Blackwell Publishing. Price £125.00 (hard covers). ISBN 1 4051 0018 4. doi:10.1017/S0016756807003639

In the last decade the burgeoning field of glaciology has seen the publication of several textbooks that demonstrate the subject's interdisciplinary nature, and its increasing importance in the context of understanding global environmental change. Hence, practitioners frequently need updates and syntheses of key topics within the field. Therefore, the glaciological community will find *Glacier Science and Environmental Change* especially welcome.

The book is divided into five parts, each with a keynote introduction by a leading specialist, followed by topical reviews and case studies, together totalling no less than 92 contributions. The major themes are: glaciers and their coupling with hydraulic and sedimentary processes; glaciers, oceans, atmosphere and climate; changing glaciers and