

Written by an international cast of 33 authors, this big book has 21 chapters, grouped into five parts, beginning with a general introduction to the Crato Formation Konservat Lagerstätte (in six chapters) and then runs through the invertebrate fauna (11 chapters with the insects being further divided into another 21 sections), the vertebrates (seven chapters), flora (two chapters) and finally miscellaneous bits and pieces; each chapter and section has its own bibliography. A glance through the references shows that for such a big book, that must have taken some time to put together, the individual authors have managed to be pretty well up to date with references to work published as recently as 2005 and 2006. Finally, there is a very useful species list and systematic index but no general index.

For palaeontologists, no matter what your specialization, this is a book to enjoy at your leisure even if it is just for the innumerable excellent illustrations which include 32 colour plates and countless drawings of the marvellous diversity of arthropods, especially the insects (over 100 species). As Günter Bechly points out, the early Cretaceous (probably late Aptian) age Crato Formation limestones and their fossils preserve an unusual mix and diversity of terrestrial and aquatic taxa. Furthermore, they record a time 'when plant/insect co-evolution was in its early stages' and since both plants and insects are particularly well preserved here, the biota is of particular interest over and above the obvious attributes of diversity and quality of preservation. However, the most frequent groups are 'Orthoptera, Blattaria, Hemiptera and Ephemeroptera... which together represent more than 80% of the fossil arthropod material based on a study of 3651 fossil arthropod(s)...'.

As with many historically famous fossils from platy limestones, most of the fossils from the Crato Formation have been found by stone workers in the course of splitting the rock for commercial purposes. The fossils are put aside for sale through a network of dealers and eventually the best reach an international market. Without such commerce most would never be found. However, the entire Chapada Araripe region has now come under protective environmental legislation and is in the process of becoming Brazil's first Geopark which will protect a number of internationally significant localities and provide educational facilities. Hopefully this will ensure a good balance between necessary commercial activity and protection of scientifically important sites.

Douglas Palmer

References

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MILLER III, W. (ed.) 2007. *Trace Fossils. Concepts, Problems, Prospects*. xxiv + 611 pp. Amsterdam, Boston, Heidelberg, London: Elsevier. Price £110.00, US \$185.00, Euros 155 (hard covers). ISBN 9780 444 52949 7.
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Ichnology is a rapidly expanding field that is finding applications in many different fields, from the search for early life on Earth, to petroleum geology, sedimentology, evolutionary palaeobiology, archaeology and zoology among others. This

interesting compilation of papers comes in a number of different formats from historical geology to review articles and original contributions. The editor has organized these into three sections: 'Historical Background', 'Concepts and connections to the earth and biological sciences' and 'Advances, fresh approaches and new directions'.

The 'Historical background' section hides a review of the ichnofacies model of Seilacher by MacEachern *et al.*, which provides for the first time very welcome definitions of new terminology that has been used in ichnofacies papers for the last 10 years or so.

For the non-expert, there is an excellent section on the preservation of trace fossils and the terms used to describe them in the 'Concepts and connections to the earth and biological sciences' section. The review of ichnology and sequence stratigraphy, also by MacEachern *et al.*, while effectively the same as that published by the same group of authors in 2004, is also worthwhile for someone new to ichnology. The same could be said for several of the papers which appear in very similar form in McIlroy (2004).

Highlights from the last sections of 'Concepts and connections to the earth and biological sciences' and in 'Advances, fresh approaches and new directions' include Miller & White's state-of-the-art review of lake ichnofacies, which involves integration of lake processes and trophic webs in a manner that is likely greatly to improve the understanding of the ichnology of such systems. Also in the same section is an excellent review of the biomechanics of burrowing by Jumars *et al.* that links sediment properties with burrowing mechanisms that, for me, helps to explain a lot of what I have found puzzling in trace fossils for many years.

In summary the volume is excellent in its scope, though its claim to be state-of-the-art is somewhat let down by the authors borrowing heavily on their earlier 2004 papers. I suspect that the book was a long time in press as many of the papers do not cite works after 2004. The reprographics in the volume are excellent, I would certainly recommend it as a library reference text to support other reading for students, and specialist ichnologists will find many little treasures of knowledge in the volume.

Duncan McIlroy

Reference

- MCILROY, D. (ed.) 2004. *The Application of Ichnology to Palaeo-environmental and Stratigraphic Analysis*. Geological Society of London, Special Publication no. 228, 496 pp.

- LEWIS, H. & COUPLES, G. D. (eds) 2007. *The Relationship between Damage and Localization*. Geological Society Special Publication no. 289. v + 247 pp. London, Bath: Geological Society of London. Price £80.00, US \$160.00; GSL members' price £40.00, US \$80.00; AAPG/SEPM/GSA/RAS/EFG/PESGB members' price £48.00, US \$96.00 (hard covers). ISBN 9781 86239 236 6.
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This relatively slim Special Publication covers a broad topic in rock deformation: why some deformation is distributed through large rock volumes and other deformation is localized in narrow zones. The focus of the 12 collected papers is on the upper crust. Deformation here is classically envisaged as 'brittle' rather than 'ductile', though the volume shows that this view is over-simplified. There are few definitive answers in this collection to problems of upper crustal deformation, but some stimulating papers that better define some good questions to ask.

A number of themes recur through the volume. The scale-dependency of 'damage' and 'localization' is most problematic, with localized deformation at one scale typically comprising a distributed damage zone at a smaller scale. Mechanistically, an important theme is the distinction between materials that strain harden, and therefore distribute damage, or strain soften and therefore localize it. One important control on such behaviour is whether a rock needs to dilate during deformation or whether it can compact due to an initially loose grain packing. A major theme is that texture and mechanical behaviour of materials evolves during deformation, so that deformation is non-linear. If there is a unifying theme through the volume, it is that this non-

linearity allows deforming rocks to be seen as self-organizing systems, striving to achieve some least work condition.

Collections of papers into thematic volumes too often suffer from too much diversity and not enough cohesion. That risk in this collection is averted by an excellent introduction by the editors. Such introductions can sometimes be little more than a linked list of contributing authors. Instead, Couples and Lewis provide a thoughtful and incisive review, clearly outlining the problems of damage and localization and signposting future research directions. Supported by a strong set of papers, this volume is therefore a useful addition to the literature on rock deformation.

Nigel Woodcock