



**Trace fossils as indicators of sedimentary environments**, edited by D. Knaust & R.G. Bromley, 2012. *Developments in Sedimentology* 64. Elsevier, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. Hardback, 924 pages. Price (also for the e-book) € 140.00. ISBN 978-0-444-53813-0.

Ichology may be not so new anymore, but it remains a rapidly evolving discipline, and its importance increases together with the development of sedimentology, stratigraphy (especially sequence stratigraphy!), and petroleum geology, which have progressed strongly during the past decade. The thick volume edited by Knaust & Bromley is therefore published at the right time.

The book focuses on the application of trace fossils for the analysis of sedimentary environments. A total of 28 chapters written by high-reputation professionals provides a solid foundation for trace-based paleoenvironmental analysis. In addition, a lot of supplementary but essential knowledge (e.g., that on ichnosystematics and neoichnology) is also supplied. The high level of complexity of information presented in this volume reflects adequately the complex relationships between ichnofossils and the conditions under which they were formed.

The first part of the book consists of not less than 10 chapters. These chapters shed light on the basic concepts and some modern problems, including the modern ideas about ichnofacies and ichnofabrics, as well as the sequence-stratigraphic importance of traces. Here, I wish to note the nice summary of the history of trace fossils studies from the very beginning to nowadays. However, some relevant material is presented as online supplements, and I would prefer to see this material published directly in this volume or attached to it on CD or DVD. In his contribution, Knaust attempts to arrange the complex systematics of 585 valid ichno-genera. Impressive, isn't it?! I suppose that many readers will be interested in Chapter 9, which reviews the ichnological approaches that are currently followed. These include outcrop observations but there are also more sophisticated approaches; computer-aided tomography permitting 3-D visualization of traces is only one of them

The core of this volume is consists of the second, third, fourth, and fifth parts. These deal, respectively, with continental and glacial, shallow-marine siliciclastic, deep-marine siliciclastic, and marine carbonate environments. The peculiar depositional systems of rocky shorelines and carbonate build-ups are included. Unfortunately, particular environments are characterized in a somewhat divergent way. The resulting lack of uniform storytelling makes this book somewhat chaotic. For instance, Melchor *et al.* pay attention to the morphology of traces from fluvial facies (look at their nice Table 1, p. 331-334), the characteristic features of fluvial ichnofacies, and the description and the comparison of ichnological peculiarities of some main fluvial (sub)lithofacies. In contrast, Zonneveld *et al.* address the spatial and temporal variability in lithofacies of mixed siliciclastic/carbonate deposits and accompanying changes in trace fossils; this is discussed with a series of representative examples; finally, shell debris is mentioned. The last part, consisting of only two chapters, is devoted to characterization of hydrocarbon reservoirs and aquifers by using ichnology.

Beyond any doubt, this volume deserves full respect for its numerous achievements. Let me refer in this context to, for example, the model proposed by Scott *et al.* that links lake-basin types, lake-basin zonations, and ichnological patterns. The knowledge on the

evolution of trace-making in deep-sea fans through the Phanerozoic (see the contribution by Uchman & Wetzel) will be interesting to many paleobiologists. A special discussion of ichnofacies in chalk, offered by Svrda, is a new step in understanding the relevant depositional environments and the origin of this peculiar rock type.

This comprehensive book is certainly up-to-date, although the readers should not forget, however, that the knowledge on trace fossils evolves rapidly. This volume focuses on the application of ichnofossils to the analysis of sedimentary environments, even if it provides a great deal of knowledge about the traces themselves. Secondly, the volume contains so much information that one can easily "drown" in it. The organization of the book is clear and the subject index is detailed, which helps when looking for a solution to a trace-fossil problem.

Considering all this, the volume complements the works by Hasiotis (2006), Seilacher (2007), and Buatois & Mángano (2011), but it does not replace these monumental works. Imagine a situation when one has just found a trace fossil. Now, the researcher wishes to reconstruct the depositional environment. If no evidence is available from previous studies, the book will not help significantly, because it characterizes ichnofossils by depositional environments, which means that the latter should be known already. Well, one can try to remember the entire volume and reorganize it mentally in order to transform it into an effective tool for paleoenvironmental reconstructions. But is this realistic considering the amount of information in this book? Another way is to search for the distribution of trace fossils by environment through the subject index, but this is not so easy either (say, if you have *Ophiomorpha*, the subject index refers to more than 70 pages!). Such a problem could be solved by not focusing primarily on sedimentary environments but rather on traces or rock types.

The above criticism is certainly not meant to judge the volume as weak, on the contrary. The reader should realize, however, that this book is a theory-oriented synthesis of the present-day knowledge (and this should be appreciated!) rather than a practical guide. Theorizing, summarizing, classifying, finding common patterns, and demonstrating modern techniques are distinctive and strong features of this book.

Regarding the editorial aspects, it should be mentioned that the editors did not only co-ordinate the work of many specialists, but arranged particular chapters logically (they apparently decided which chapters were required to make their book really comprehensive). In other words, the volume is not a mere collection of contributions, but a balanced, unified book. Illustrations are numerous, accurate, and often colorful. Both the block diagrams and the images illustrating trace fossils of particular environments are very useful. Of course, minor errors occur; for instance *Urohelminthoida* is to be found on p. 107, and not 106 as indicated in the subject index. On p. 857, the country's name "Colombia" is misspelled. An error occurs also on the back cover, where - though the book actually consists of six parts - only five parts are indicated!

This volume is a must-read for all ichnologists, but not only for them. Specialists in sedimentology, basin analysis, sequence stratigraphy, paleogeography (*sensu lato*), and paleontology will find it enriching. With regard to its very rich content and academic style, I recommend it as an advanced reading to professionals. If students have a good knowledge about trace fossils, they will also find much of their interest in this volume.

## References

- Buatois, L. & Mángano, M.G., 2011. *Ichnology: organism-substrate interactions in space and time*. Cambridge University Press, Cambridge, 358 pp.
- Hasiotis, S.T., 2006. *Continental trace fossils*. Society for Sedimentary Geology, Tulsa, 132 pp.
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