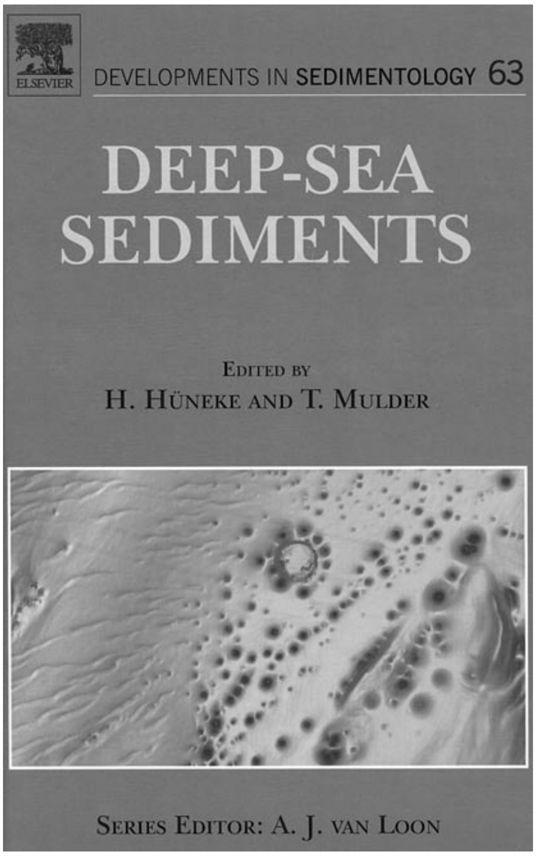
Deep-sea sediments, edited by H. Hüneke & T. Mulder, 2011. Developments in Sedimentology 63. Elsevier, Amsterdam. Hardbound, 849 pages. Price USD 195.00. ISBN 978-0-444-53000-4.



This thick (849 pages), thematic volume, with a broad title is refreshing. It is composed of 12 chapters. Following an introductory chapter (Ch. 1) by Mulder, Hüneke & Van Loon, Mulder (Ch. 2) sets the stage for the entire book with his perspectives on deep-sea processes. His focus on the 'Bouma sequence', the 'Lowe sequence', and Mutti's facies scheme clearly establishes the conceptual foundation for the book that sandy and gravelly turbidity currents are the primary processes for transporting and depositing sand and gravel in the deep sea. There is, however, one major chronic problem with this basic tenet. To date, no one has ever documented gravelly or sandy turbidity currents in modern oceans using vertical sediment-concentration profiles. Nor has anyone ever replicated turbulent turbidity currents that could carry coarse sand and gravel in suspension in laboratory flume experiments. In the absence of empirical data on sandy and gravelly turbidity currents, genetic turbidite-facies models are irrelevant for interpreting real-world sandy and gravelly deposits.

Despite the lack of empirical data on natural sandy turbidity currents in modern oceans, sandy turbidites have been the single most commonly interpreted facies in the ancient stratigraphic record. If the palaeo-oceans were truly inundated with sandy turbidity currents, then they should be equally omnipresent in the modern oceans. But they are not! In stark contrast to elusive sandy turbidity currents in modern oceans, sandy mass-transport processes have been documented by direct observations and underwater photographs in modern submarine canyons (Shepard & Dill, 1966), but Mulder has decided to ignore these empirical observations that have been made during the past fifty years.

It is worth noting that both the 'Bouma sequence' and the 'Lowe sequence' have never been reproduced in flume experiments. Complete sequences of these two models have never been documented in deposits on the modern sea floor. Finally, Mulder discusses the importance of sequence stratigraphy in deep-sea turbidite systems, without acknowledging recent developments in the field. For example, systematic studies of seismic-core calibration in the North Sea and Norwegian Sea have shown that sequence-stratigraphic concepts are obsolete for deep-sea systems (Shanmugam, 2007). By failing to acknowledge observations made by others that do not conform to his views, Mulder presents a distorted view of deep-sea sedimentation.

Chapter 3, on contourites, also suffers from major omissions and distortions. Examples are:

(1) In introducing the topic, Faugères & Mulder include two figures, one showing ocean surface currents (Fig. 3.1) and the other one thermohaline circulation (Fig. 3.3). The captions of these two figures do not give any credit to data sources. What are the original

sources of data used in constructing these two figures?

(2) Faugères & Mulder discuss 'Geostrophic thermohaline circulation' in Section 2.2. What is striking is that the entire section does not include a single reference to earlier contributions by pioneering researchers on this topic. Are Faugères and Mulder the original authors of the concept of the thermohaline circulation?

(3) Without any justification, Faugères & Mulder have selected thermohaline-driven contour currents as the sole example of bottom currents, but there are four types of bottom currents (a) thermohaline-driven currents, (b) wind-driven currents, (c) tide-driven currents, and (d) internal-tide driven currents (Shanmugam, 2008). If Faugères and Mulder disagree with my assertion on four types of bottom currents, the normal course of action for advancing science is to provide data that dispute my claim and justify their selection of contour currents as the candidate for bottom currents.

(4) There is a considerable body of data and literature on deep-marine tidal bottom currents and their deposits. Again, Faugères & Mulder totally ignore this topic, without any justification.

(5) Faugères & Mulder (their fig. 3. 18) have used the contourite-facies model published in 1984. This model has undergone major revisions recently by Stow & Faugères (2008, their fig. 13.9). In this revised model, there are five internal divisions (C1, C2, C3, C4, and C5), analogous to the Bouma turbidite model. But Faugères & Mulder have neglected to include the most recent version of the contourite model, without any explanation.

(6) Both the original and the revised contourite facies model are fundamentally flawed. The three distinguishing criteria of contourites, according to Faugères and Mulder (p. 178-179), are: (a) abundant bioturbation, (b) bad preservation of primary structures, and (c) coarsening-up and fining-up grain-size trends. First, bioturbation is common in all parts of turbidites, and not unique to contourites. Second, the logic of using lack of sedimentary structures for interpreting processes goes against the founding principle of process sedimentology in which primary sedimentary structures are the sole foundation for interpreting depositional mechanics. Third, coarsening-up and fining-up grain-size trends are not unique to contourites because they are also common in hyperpycnites (see Fig. 2.12C). More importantly, none of the three criteria reveals anything unique about contour-following bottom currents in order to qualify the deposit as contourites.

(7) Another deliberate omission from this chapter is the discussion of the importance of traction structures in bottom-current deposits. The significance of traction structures in bottom-current deposits has been the focus of discussion since the 1960s.

After reading Chapter 3, one gets the impression that these authors operate in a distant parallel universe, with a total disregard for publications by other authors with a different point of view.

Chapters on pelagic (Chapter 4), hemipelagic (Chapter 5), benthic carbonate (Chapter 6), and volcaniclastic (Chapter 7) sediments provide good reviews of individual topics.

After a review of deep-sea ichnology (Chapter 8), Uchman & Wetzel realised that trace fossils that are commonly considered as typical for shallow-marine environments (e.g., *Ophiomorpha*) can occur also in the deep sea, thus implying that trace fossils may not be a reliable indicator of the depth of marine environments.

Hesse & Schacht (Chapter 9) provide an exhaustive and excellent treatment of early diagenesis of deep-sea sediments. The authors focus on muddy sediments with a special section dedicated to highly reactive volcanogenic sediments.

In Chapter 10, Imbert presents a comprehensive account of various elements of petroleum exploration and production.

Weissert (Chapter 11) traces the close interaction between marine- and land-based geologists since the late 19th century, and discusses the value of integrating sedimentological, micropalaeontological and geochemical data with the 'earth-system concept' in understanding the evolution of oceans, life and climate through time.

Finally, Bickert & Henrich (Chapter 12) objectively discuss both sides of the controversy surrounding the onset of the northern-hemisphere glaciation.

In summary, the volume meets its goal in most chapters, but falls short in Chapters 2 and 3 by failing to include the following critical topics: (1) sandy mass-transport deposits; (2) deep-marine tidal currents and their deposits; (3) deep-marine internal tides and their deposits; and (4) the influence of tsunamis and tropical cyclones on deep-sea sediments.

References

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