Applied Sedimentology second edition

by Richard C. Selley, 2000; Academic Press, 525 B Street, Suite 1900, San Diego, CA 92101-4495; 523 pages, hardbound; $82.50; ISBN 0-12-636375-7

In this second editon of *Applied Sedimentology*, Selley makes it abundantly clear that the book is aimed at the reader who aspires to be an industrial, hence applied geologist. His mission is to help bridge what he perceives to be the widening gap between more traditional, field-based sedimentology and modern, more model-driven studies -- the gap between practitioners with wilderness survival skills and work stations. In this back to basics, “let's not throw the baby out with the bath water” approach, Dr. Selley preaches the message that we must combine the best aspects of both – modelers must know something about what is being modeled. Attempts at ground-truthing the rock record must precede the modeling of sedimentary systems. Selley describes this book as an unrepentant discourse on **sensual sedimentology** – understanding “sediments in the wild” in order to establish the firm foundation on which to interpret sediments remotely sensed by high-tech geophysical tools and elegantly displayed by computers. The message is a sound one and should be heard and read by the intended audience.

This is a clearly, crisply, and tightly written book with a pleasing style, spiced liberally with a wry, occasionally refreshingly sardonic, sense of humor, and logically and simply organized. Illustrations are adequate, but not exceptional, but generally do a creditable job of illustrating the intended point. The three-part organization of *rocks to sediment, sediments sedimented, and sediment to rock* is a catchy theme that continually underscores the holistic nature of the sedimentary cycle – the spectrum of weathering, particle generation, depositional processes and environments, development of facies successions and sequences in response to changing base levels, subsurface environments and diagenesis, and basin evolution and analysis. The book provides a nice succinct overview of the diverse field of sedimentology, with good linkage between older and newer concepts.

Selley sets the tone and lays out the road map in a good, reader-friendly Introduction (Chapter 1), placing sedimentology in a historical context and the evolution of geologic thought. “Rocks to sediment” begins with Chapter 2 and a treatment of weathering. Here through statement and by example, sedimentology is quickly shown to be deeply rooted in the fundamental sciences of chemistry, physics, and biology. In Chapter 3, particles, pores, and permeability, Selley does a masterful job of showing how the fundamental properties of primary porosity and permeability of sedimentary deposits, part of the “life blood” of applied sedimentology, are related to particle size, shape, sorting, roundness, textural maturity, sedimentary structures, and fabric. How porosity and permeability are measured is an excellent adjunct, generally not treated in other sedimentology texts.

“Sediments sedimented” begins with Chapter 4, which deals with transportation and sedimentation processes. Mechanics of transport and deposition are deftly intertwined, and turbidity, traction, pelitic, hemipelagic, and gravitational processes are treated as end members in a continuum of particle entrainment, transport, and deposition. The subject of flow regime relates nicely to traction processes and products, and its application to the Bouma turbidite model is given more than the customary cursory treatment. Eolian and moving water process examples provide a nice lead-in to later discussions of depositional environments. Quantification aspects are liberally sprinkled throughout the chapter. In Chapter 5 on sedimentary structures, biogenic structures are given somewhat short shrift, but inorganic, physical structures are treated in appropriate level of detail and their formation is related to the processes discussed in the previous chapter; Selley stresses the importance of this linkage in maintaining continuity in thinking from chapter to chapter. Some of the photographs are of marginal to poor quality, which detracts a bit from the otherwise total positive impact. The chapter ends with a good treatment of paleocurrent analysis, an important aspect of applied sedimentology. Chapter 6, depositional systems, is much too long and ambitious (>120 pages). Selley should have split this into at least two and perhaps three chapters for more clear and efficient organization: at a minimum one treating terrigenous/siliciclastic depositional systems (where detrital composition really “doesn’t matter” – siliciclastic detritus is made, not born), and a second chapter dealing with siliciclastic facies analysis,

cycles, and sequence stratigraphy. Walthers Law should be introduced earlier when discussing the linkage of adjacent environments into depositional systems. Because carbonate and other nonsiliciclastic sediments are “born, not made” and their composition does figure importantly in considerations of environments, the discussion of their depositional systems, cycles, and sequence stratigraphic expression should be treated in a separate chapter, after the classification schemes have been developed (present chapter 9 on autochthonous sediments). This is not a condemnation of an otherwise informative, albeit long chapter.

“Sediment to rock” begins with Chapter 7, and is the focus of the applied theme – treating the subsurface environment and the generation, migration, and entrapment of geofluids. The emphasis is on hydrocarbons, with ground water being a bit short-changed; however, the discussions of fluid flow phenomena are lucid. While making a picturesque color plate essay, the photomicrographs are a nice touch, but marginal quality of some detracts from their desired effect, and in my view a more efficient and perhaps meaningful set of illustrations would have been various geophysical logs, illustrating subsurface simulation of stratal successions. The two color plates on sequence stratigraphy are out of place and would better fit the sedimentary model-sequence stratigraphy discussion in the previous chapter 6. Chapter 8 on allochtonous/siliciclastic rocks provides a good overview, and while this reviewer would have chosen other classification systems, the points stressing detrital composition and provenance implications are adequately made; however, sandstone composition also should have been cast in a plate tectonics framework to put provenance in its broader, more meaningful perspective. The other side of the porosity and permeability coin -- diagenesis – is nicely developed and also is related to the previous chapter on subsurface environment as well as by building a bridge back to earlier discussions of primary porosity – the ”then” versus the “now” – how compaction and cementation can ruin what started out as a nice reservoir rock. Chapter 9 treats autochthonous/nonsiliciclastic sediments reasonably well, although the section on coal should have come after the chemical precipitate sediments/rocks. Once again, carbonate depositional systems, cycles, and depositional sequences should be treated after the classification systems are developed. I especially liked the section on carbonate diagenesis and the treatment of

paleokarst and significance of unconformities in the dissolution and subsequent diagenetic history of carbonates.

Finally, the preceding saga of *rocks to sediment, sediments sedimented, and sediment to rock* culminates in a capstone chapter 10 on sedimentary basins. Here Selley addresses the cogent questions: Why should various sedimentation styles occur in particular places at particular times? What controls the spatial organization of large volumes of sediment? What are the factors that control their facies? And how do hydrocarbons and mineralizing fluids move throughout sedimentary basins? Selley re-introduces the concept of accommodation space as a key component of sedimentary basins and their record of sediment accumulation and then proceeds to explore the geodynamic models of basin formation and the classification of basins, all woven into a tapestry with plate tectonics and climate. Within this framework Selley returns to the applied theme with a view of the petroleum system in the context of basin evolution – thus coming full circle on the central theme of the book: the integration of the full spectrum of sedimentary processes and their control on the genesis of petroleum and other minerals – applied sedimentology.

Although the case histories and examples are typically non-North American, this should not dissuade the book's usage by a North America readership. The important consideration here is content and readability, where this book scores high marks with this reviewer. Reference lists are lengthy and up to date, and the book qualifies well as a stand alone basic sedimentology text or as a companion text or reference for a petroleum geology or petroleum engineering course. What should be the role of a geology textbook? – especially with so much good information available on the internet and with professors having course web pages devoted to additional resources. Should the book be readable, informative, and comprehensible, and weave a thread of continuity that stitches key concepts together, as well as provide a handy reference along with other information sources? If this is the expectation rather than its being a panacea or last word on the subject – then this book fills the bill admirably. It is a good read, it is informative, and well worth the modest price.

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