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# Precambrian Sedimentary Environments: A Modern Approach to Ancient Depositional Systems

## Reviewed by Frank Corsetti

Edited By: Wladyslaw Altermann and Patricia Corcoran
Blackwell, Oxford, 2002, 464 pp.
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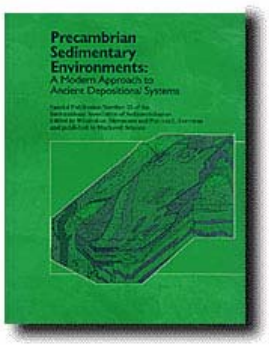
*Precambrian Sedimentary Environments: A Modern Approach to Ancient Depositional Systems,* edited by Altermann and Corcoran, contains an interesting collection of review articles and case studies predominantly united by the theme that modern approaches can be used to investigate Precambrian sedimentary successions. This book should find its way on to the shelves of anyone interested in Precambrian sedimentary successions. Since this review is for *Palaeontologica Electronica,* I will state at this point that there is very little paleontology presented in this volume. The reader who is interested in Precambrian life would be better served with a copy of Knoll's *Life on a Young Planet: The First Three Billion Years of Evolution on Earth.*

Nearly all of the papers focus on siliciclastic sediments; carbonates receive little treatment. Perhaps the title of the volume should have alerted the reader that the volume was predominantly devoted to siliciclastic sediments. In this way, it could have been considered a siliciclastic counterpart to the volume edited by Grotzinger and James in 2000 on carbonate sedimentation and diagenesis in the evolving Precambrian world.

What exactly is meant by 'modern approaches' to Precambrian depositional systems? The editors propose that methods applied to Phanerozoic successions can successfully be applied to Precambrian strata, too. A glance through the sedimentologic literature and journals such as Precambrian Research would suggest that this has been going on for years. Do Precambrian geologists have a separate set of tools with which to decipher the geologic record? The introduction and the first review article state their case for modern approaches more clearly: the present is the key to the past, even in the Precambrian. The term actualism is used, rather than uniformitarianism, and the nuances of these terms are the subject of the first review paper, discussed below. Most of the case studies use standard facies analyses based on modern depositional systems to interpret the Precambrian record. This approach works well as applied in this volume (which nearly omits carbonates where the actualistic approach might be more problematic).




Several of the review chapters (the first 25% of the book) will find broad appeal. The chapter on the evolution of the Precambrian sulfur cycle and

secular variation by H. Strauss is thorough and includes a significant amount of new data (several compilation diagrams from this chapter will not doubt make their way into future textbooks and reviews). The summary chapter by D. Sumner highlights the fact that carbonate precipitation on Neoarchean carbonate platforms was vastly different from today, with seafloor-precipitated fans as the major structural component (and provides the only paper in the volume to feature carbonates exclusively). The review chapter on iron-formation represents a good description on Precambrian iron-formation, but may be less compelling with regard to new insights regarding the significance of iron-formation. Notably absent is any mention of Canfield's work on the demise of iron formation via sulfide scavenging versus the oxygenation of the deep oceans, an idea published in 1998 that is gaining recent support. One review chapter is devoted to the evolution of life and its influence on sedimentation, but it seems a bit out of place in this book, given the strong sedimentological theme.

The temporal distribution of the fourteen case studies in the remainder of the book wanders throughout the Precambrian (five for the Archean, six for the Paleoproterozoic, and three for the Neoproterozoic, two of which focus on glacial episodes…direct treatment of the Mesoproterozoic is missing altogether). Some less well-known basins are presented in the case study section, which is a positive characteristic of this volume. The editors make a point to break from the geographic bias that they feel pervades the geologic literature even today. The Precambrian strata in Venezuela, India, and Brazil are featured alongside Canada, Norway, South Africa, and Australia. If the purpose of the case studies was to demonstrate that facies analyses based on modern depositional environments can be used in Precambrian successions, then the editors were successful in assembling a set of articles in support of their purpose. On the other hand, the Mesoproterozoic was conspicuously absent from this volume, as were treatments from aerially significant Precambrian regions (China, for example).

This volume represents a good collection of primarily siliciclastic Precambrian case studies, and as stated, should enter the collection of anyone interested in Precambrian siliciclastic sediments. However, I must take issue with the concept of actualism presented in the first chapter and used as a theme throughout the volume. The first review article defines actualism as "…the same processes and natural laws applied in the past as those active today" (p. 3). The authors argue that the term "non-actualistic" should be abandoned as semantic and confusing, and personally attack Friedrich Pfluger's use of the term in relation to certain sedimentary structures. They argue that any Precambrian environment can be understood via processes operating today. While it is true that many structures can be understood by modern analogue, I submit it is useful to have a term that denotes the 'unusualness' of certain features found in Precambrian rocks, and in my view, the term non-actualistic fits the bill. Perhaps my bias stems from the fact that I study carbonates which are not the focus of the volume and which are demonstrably non-actualistic in Precambrian environments. Sumner's review of Archean carbonate platform sedimentation in this very volume is a good example of the major differences between modern carbonate sedimentation and Archean carbonate sedimentation. The authors come close to admitting that some cases may indeed be non-actualistic when they raise the issue of Neoproterozoic Snowball Earth.To illustrate my view, let's take a wrinkle mark as a case study in non-actualism. Wrinkles are formed through microbial binding of siliciclastic sediment; they are relatively common in environments today where harsh tidal conditions exclude metazoans, allowing the microbial mats to form (e.g., Noffke, 2001). In the Precambrian, wrinkle marks are found in all depositional settings, not simply tidal environments (e.g., Hagadorn and Bottjer, 1999). In this way, the distribution of wrinkle marks in Precambrian rocks is non-actualistic (not like today). Yes, we understand how they form by our observation of the modern, but we would be misled if we then interpreted all wrinkle-bearing units as tidal. The same argument can be made for stromatolites. I agree that the Precambrian world operated under the same laws of physics as today, but I disagree that the exact same processes operated then as now. The process of subtidal wrinkle mark formation and preservation does not occur today, and therefore a subtidal occurrence of wrinkle marks in ancient sediments is non-actualistic. The term non-actualistic should not be abandoned.