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Why do Carbonates Systems Buck the Trends of Sequence Stratigraphic Models?

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ABSTRACT

It is a common practice to apply the sequence analysis methodology derived largely from siliciclastics to carbonate systems. Nevertheless, few of these approaches address the specifics of carbonate systems, and sometimes red and blue triangles are placed using the grain size trends or changes in sediment patterns, which, in carbonates, may or may not be meaningful. When analyzing carbonate systems, "the absence of rules" becomes the rule, and instead using the changes in biotic components to infer the sea-level trajectories can more accurately capture the specificity of each example.

In the analytical strategy for constructing a meaningful reservoir model, building a realistic depositional model is a prerequisite, but in carbonates these can be further refined. In carbonate systems, the process/product relationship is much more complex and diverse, with several feedbacks and responses that may or may not be linear. Moreover, there is no a unique and consistent response of the system to the changes in accommodation as this may be either be driven by changes in the physical space (physical accommodation) or by the building capacity (ecological accommodation) of the system. Also, bedding patterns and bounding surfaces alone may not be of much utility. Rock packages bounded by physical surfaces are better characterized by changes in relative sea level due to the depth dependence of many carbonate-producing organisms. Having this powerful tool, there seems no reason to remain wedded to analyzing the less reliable bounding surfaces.

In carbonates, genetic analysis (process-product relationship) carried out on the composition and preservation of the skeletal- and non-skeletal components has proven to be very useful procedure. It permits to more accurately determine the changes in paleobathymetry, reflecting changes in accommodation. "Eco-stratigraphy" is becoming very useful to interpret platform carbonates and predict the architecture and distribution of facies heterogeneities. It requires knowledge of basics of paleoecology, but it has the potential to become a fully predictive technique. The limits to this analytical strategy are set by the knowledge (or lack thereof) of the ecological requirements of the ancient biota. Its advantage is that, in all cases, it generates new questions that lead us to look for answers that, in turn, yield more realistic interpretations and enhanced predictions of lithofacies heterogeneities.