WHAT IS WRONG WITH CARBONATES?

L. Pomar

*Universitat de les Illles Balears, Ctra. Valldemossa km 7.5, Palma de Mallorca, Spain, *e-mail: luis.pomar@uib.es*

In sedimentary geology, interpreting depositional systems is the first step required for reconstructing Earth history, understanding the processes operating on Earth and how to handle environmental issues or to effectively manage natural resources. Conceptual knowledge evolved from descriptive stratigraphy, through the process-oriented sedimentology (depositional environments), and has reached the current status through spatial-temporal basin-wide integrative correlation in sequence stratigraphic analysis. In this saga, however, carbonate rocks remained subordinated to the concepts developed for siliciclastic depositional systems despite the differences existing between these two rock types. Whereas sediment components are mostly sand to clay in siliciclastics, changing components, rock textures, lithofacies, platform types and architectures throughout time are specific peculiarities in carbonates.

Comparative sedimentology has been very efficient in differentiating depositional systems, from glacial to deep basin in siliciclastic systems, whereas depositional systems lacking modern analogs are recognized in carbonates. The critical difference is that siliciclastic systems are controlled mainly by time-independent physical laws, but in carbonate systems time-dependent biological processes operate that rely on the adaptative capacity of the biotic systems to respond to environmental changes linked to biological evolution. Thus, the further back in geological time the carbonates were produced, the more likely modern analogs are not applicable.

When interpreting the building blocks of stratigraphy and the way they stack to create depositional sequences, it is commonly believed that the same interpretative rules that work in siliciclastics also operates in carbonates, although recognizing the need of caution due to the carbonates "*peculiarities*." Siliciclastic sediments, however, are sourced in the continent and enter the basin through the shoreline, from where they are redistributed by surface waves and associated currents to fill-in the energetically available space (no hydrodynamic competence). But carbonates are born and grow-up within the basin, at different depths, and some can build against the energy level (base level) at which waves and currents would affect loose sediments.

Paradoxically, and despite these differences, most manuals and course curricula treat carbonate rocks in a single chapter (e.g., Carbonate systems, or Reefs). And even more paradoxical is the misuse of the information provided by the bathymetry-dependence of many skeletal components in interpreting the sea-level trajectory that controls the stacking of the basic building blocks. Analysis based on the distribution of the skeletal components allows for a more realistic interpretation of the carbonate systems and depositional models and the way accretional units stack in building carbonate platforms.

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