CARBONATE SEQUENCE STRATIGRAPHY IN LIGHT OF "STANDARDIZED SEQUENCE STRATIGRAPHY"

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PROJECT OBJECTIVES

- Evaluate how the accommodation succession method (Neal and Abreu, 2009), as well as the stratigraphic surfaces method of Catuneanu et al. (2009), can be reconciled with unconformity-based carbonate sequence stratigraphy.
- Interrogate seismic and outcrop data if surfaces relevant for sequence stratigraphy fall into the same position in a base-level cycle in carbonates as proposed in the siliciclastic depositional models.

PROJECT RATIONALE

Sequence stratigraphy originally was based on the principle of subdividing a succession of rocks into sequences by unconformities and the correlative conformities (Mitchum et al., 1977). This unconformity-based method has been proven to be robust for giving the sequence boundaries chronostratigraphic values, but it has been increasingly replaced by two methods that focus on the stacking of the strata. The accommodation succession method uses the stacking pattern of the genetically related successions to define sequences. A key assumption of this method is that the building blocks in a sequence form in response to varying rates of coastal accommodation increase and decrease (δA) relative to the rate of sediment flux (δS) (Neal and Abreu 2009.

The second method that claims to provide a "standardization of sequence stratigraphy" subdivides the stratigraphic succession into a succession of genetic units (forced regressive, lowstand and highstand normal regressive, transgressive;

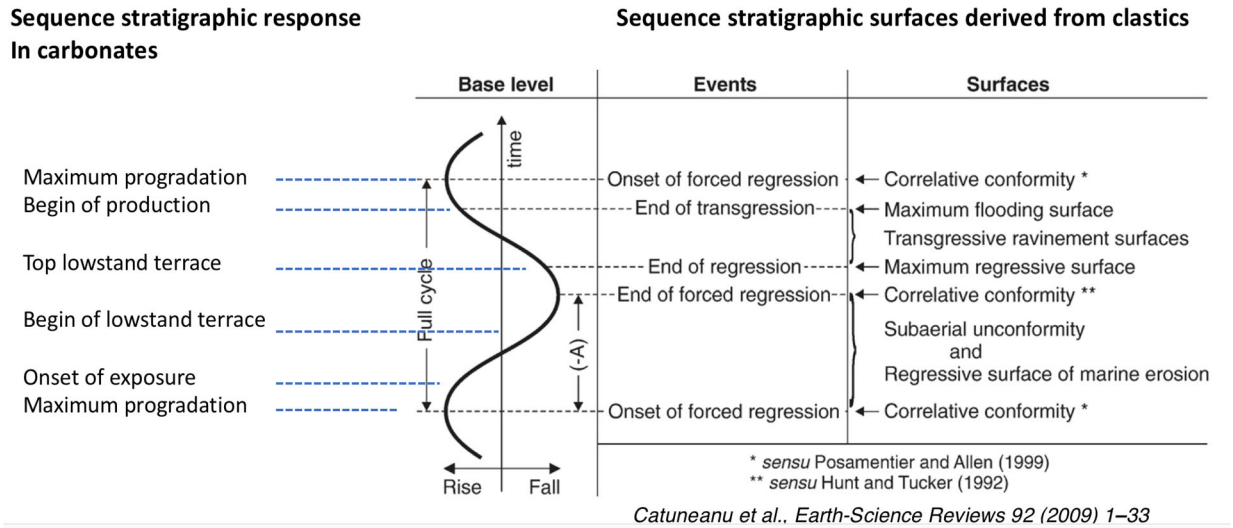

Figure 1: Comparison of response to the four events of the base-level cycle for shallow-water carbonates (left) and clastics (right from Catuneanu, 2006) and the timing of seven surfaces of sequence stratigraphy in this model and cores together with log information. The different response of the two systems and the implication for sequence stratigraphy will be explored in this project.

i.e. systems tracts) bounded by sequence stratigraphic surfaces (Catuneanu et al., 2009).

Both methods rely on the sedimentary response of the siliciclastic depositional system to base-level variations for the stratigraphic analysis and interpretation (Fig. 1). Anchoring the sequence stratigraphy on the clastics system is a necessary challenge if the methodology is to be applied to carbonates and mixed systems. Neal et al. (2016) acknowledge that in carbonate environments the accommodation succession method "can be used with caution and recognition of the complexities of carbonate sediment production and distribution rates relative to changes in rate of accommodation creation". Catuneanu et al. (2009) on the other hand conclude that the difference in carbonate systems lies only in the physical character of stratigraphic surfaces and the sediments they subdivide. Many carbonate geologists consider this conclusion as premature and untested. This project plans to test the two newer methods in carbonates by applying the two methods to carbonate successions in seismic data and in outcrop.

APPROACH

Sequence stratigraphic analyses with the three above-mentioned methods will be performed in carbonate successions. The results will be compared and interrogated regarding the implications for building sequences with these three methods in carbonates. Likewise, the formation of stratigraphic surfaces during a cycle of base-level changes will be examined in carbonates and compared to the proposed surfaces forming in clastic systems (Fig. 1). These analyses will be conducted in sites in tropical environments, cool-subtropical areas and cold-water carbonates.

GOAL AND SIGNIFICANCE

This project intends to reconcile the new methods in sequence stratigraphy with unconformity-based sequence stratigraphy and assess which elements can be incorporated in carbonate sequence stratigraphy and which are not suitable for the carbonate system. Such an interrogation is crucial for accurate interpretation of carbonate sequences using the new methods.

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