Incorporation of Currents into Sequence Stratigraphic Models

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Goals of Project

- Provide examples of the contribution of currents to continental margin sequence architecture.
- Delineate criteria for recognition of contourite drifts in a depositional sequence.
- Outline a sequence stratigraphic model that incorporates the facies both current and sea-level controlled deposits.
- Make a case that unconformity-based sequence stratigraphy is better suited to incorporate current-derived deposits than other sequence stratigraphic methods.

Rationale

Eustatic sea-level change, subsidence, sediment supply and climate have traditionally been considered the controlling factors for the sequence architecture on continental margins (Galloway et al., 1989). More recently these factors have been narrowed down to varying rates of coastal accommodation increase and decrease (δA) relative to the rate of sediment flux (δS) (Neal & Abreu 2009, Catuneanu et al. 2009). All the sequence stratigraphic methods consider the (clastic) sediment supply as a function of sediment production and gravity driven dispersal. Yet, ocean currents have a major control on sediment distribution, especially at the shelf edge and beyond where they can accumulate contourite drifts. In fact, they can produce successions that resemble sea-level controlled sequences (Betzler et al., 2013). In addition, current controlled deposits (contourite drifts) can be misidentified as lowstand systems tracts (Bashah et al., 2024), or rollover points of prograding and elongated contourite drifts are misidentified as prograding shorelines or as prograding sub-aqueous clinoforms. In addition, currents can produce abrasive terraces that resemble geometries observed in forced regressions. Yet, sequence stratigraphic models continue to explain the strata and geometries mostly by gravity-dominated

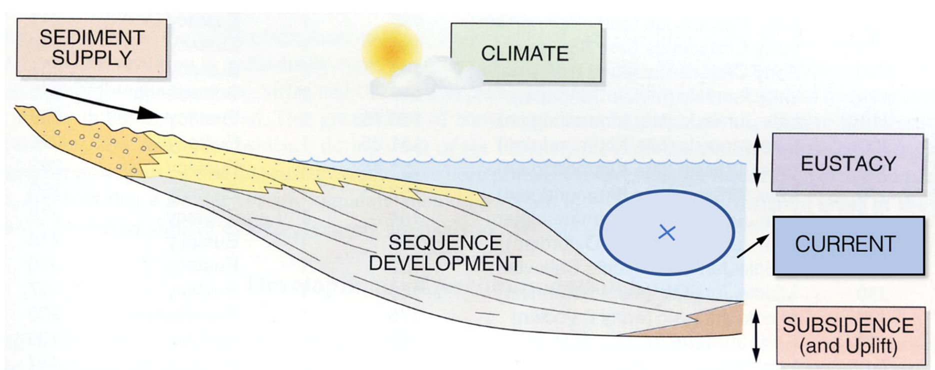

Figure 1: The controlling factors for the sequence architecture on continental margins have been sediment supply, climate, eustasy and subsidence. This project explores the contribution of the currents to the sequence development and its consequences for sequence stratigraphy.

sediment distribution within the context of fluctuating sea level. This project tests the hypothesis that current erosion and deposition are important for sequence evolution and consequently an adjustment of sequence stratigraphic models is required.

Approach and Method

We examine the architecture of carbonate and mixed carbonate/siliciclastic sequences in three areas where current activity is well documented. We will make a sequence stratigraphic interpretation, using both the traditional unconformity-based sequence stratigraphy and more recent sequence stratigraphic methods (Neal and Abreu, 2009; Catuneanu et al., 2009). In particular, we will analyze the systems tracts interpretation in regard to potential misidentification as current deposits. Furthermore, we will interrogate the interpretations of the stratigraphic surfaces when a current contribution is considered. This will lead to a test of which stratigraphic method is better capable of incorporating current deposits into the sequence stratigraphic model.

Significance

If the hypothesis that currents are a controlling factor in sequence development is proven, stratigraphic models need to be adjusted to be accurate in predicting facies distribution in the subsurface. Correct identification of the facies in the different system tracts is also paramount to building reliable static models from geometries extracted from seismic data.

References

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