Carbonate Contourite Drift Systems – Types, Dimensions and Their Importance in Deep Water Plays

Gregor P. Eberli and Sara Bashah

Project Objectives

- Continue assembling a data base of carbonate contourite systems that includes their dimensions and sedimentary characteristics.
- Use data base for a comprehensive overview of carbonate contourite drift systems.
- Evaluate current-related erosion and deposition with regard to reservoir and seal capacity.

Project Rationale and Goals

The systematic study of siliciclastic contourite drift systems over the last 20 years has led to a recognition of the importance of bottom currents in deep sea sedimentation both on a bed scale (contourite) and on the large, generally fine-grained, sedimentary bodies (contourite drifts) deposited by bottom currents (Rebesco et al., 2014). Several research expeditions to carbonate provinces provide now the information to also comprehensively describe carbonate contourite systems (Betzler et al., 2014, Eberli and Betzler, 2019). One big difference is the exposure of the carbonate system to surface currents and interaction between carbonate buildups and currents that produces carbonate specific drift bodies (Fig. 1). In addition, surface currents distribute carbonates on volcanic edifices and basement highs to produce coarse-grained facies belts that do not fit into existing depositional models.

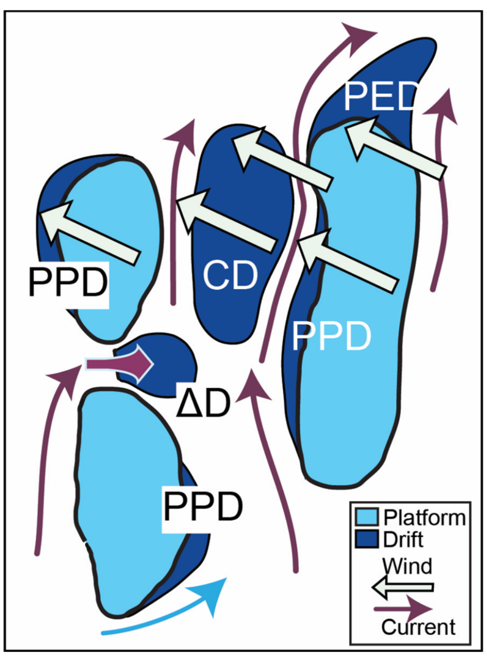

Figure 1: Three carbonate-specific types of contourite drifts that develop because of a feedback between steep morphology and sediment production and delivery to the adjacent currents.

Periplatform drifts (PPD) *form as currents hugging the slopes of carbonate platforms move offbank-transported sediment.*

Platform edge drifts (PED) *form at the confluence of currents flowing around platform edifices. They receive the sediment mostly from the adjacent platform.*

Delta drifts (DD) *is the product of (semi-) continuous flow through a channel that opens into a deeper basin.*

Thus, one goal of this ongoing project is to assemble a data base of carbonate contourites drift systems that includes their dimensions and relates the architecture and composition to the oceanographic setting. A second goal is to evaluate the carbonate drift systems with regard to their reservoir and seal capacity.

This second goal is prompted by the recognition of the importance of ocean currents within petroleum systems that has led to the discoveries of giant reservoirs like the Coral and Mamba fields offshore Mozambique (Fonnesu et al. 2020). It is highly likely that the interaction between gravity flows and currents will generate similar plays in deep-water carbonates.

DATA SETS

Seismic and multibeam data collected in expeditions by colleagues from Germany and France to the Bahamas, the Gulf of Mexico, Maldives and the Marion Platform are available for this study. Published data sets from the Caribbean, South East Asia and ancient carbonate contourite drift systems will be incorporated to assemble a comprehensive data base on carbonate contourite drift systems.

This information will be utilized to develop models of current-controlled erosion and deposition in carbonates that take into account the carbonate-specific characteristics of sediment production, grain density, and topography. These models will then be compared to depositional models in siliciclastic environments.

SIGNIFICANCE

Incorporating and/or testing a current control on the deposition of carbonates potentially improves depositional models of slope and ramp carbonates. Carbonate slope models until recently mostly considered gravity flows to be the main factor controlling distribution. Documentation of ocean currents in relatively shallow water (<300m water depth) indicates that incorporating currents as a sediment distributor might improve the existing models such as the “carbonate ramp” on seamounts and volcanic islands.

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