CARBONATE CONTOURITE DRIFT SYSTEMS

Gregor P. Eberli, Sara Bashah and Ralf J. Weger

PROJECT OBJECTIVES

- Continue assembling dimensions and sedimentary characteristics of carbonate contourite systems for a comprehensive data base of such systems.
- Examine the depositional processes of coarse and fine-grained current deposits in carbonates.
- Evaluate the potential of carbonate contourite systems as reservoir and seals.

PROJECT RATIONALE AND GOALS

The increased exploration in deep water has, over the years, triggered research in marine depositional processes other than mass gravity flows. As a result, the importance of bottom currents in deep sea sedimentation is now recognized both on a bed scale (contourite) and on the large sedimentary bodies (contourite drifts) (Rebesco et al., 2014). In addition, case studies document the interaction of bottom currents with mass gravity flows. This interaction has the potential to increase reservoir quality in the siliciclastic deep-water reservoirs as is the case in the giant reservoirs (Coral and Mamba fields) offshore Mozambique. Because bottom currents preferentially move fine-grained sediments, they produce thickness and petrophysical variability in unconventional reservoirs.

The most prolific production from current-controlled strata is in the Upper Cretaceous and Danian chalk fields in the Central Graben of Denmark, where both structural and non-structural trapping mechanisms exist (Megson,1992). In other plays, like coarse-grained distally steepening ramp settings, the current contribution might not have been recognized, fanning the notion that current-controlled deposits are not good reservoirs. It is our working hypothesis that portions of the carbonate contourite drift systems have reservoir potential, although they are generally considered a risky play. A thorough knowledge of these systems is needed to reduce this risk.

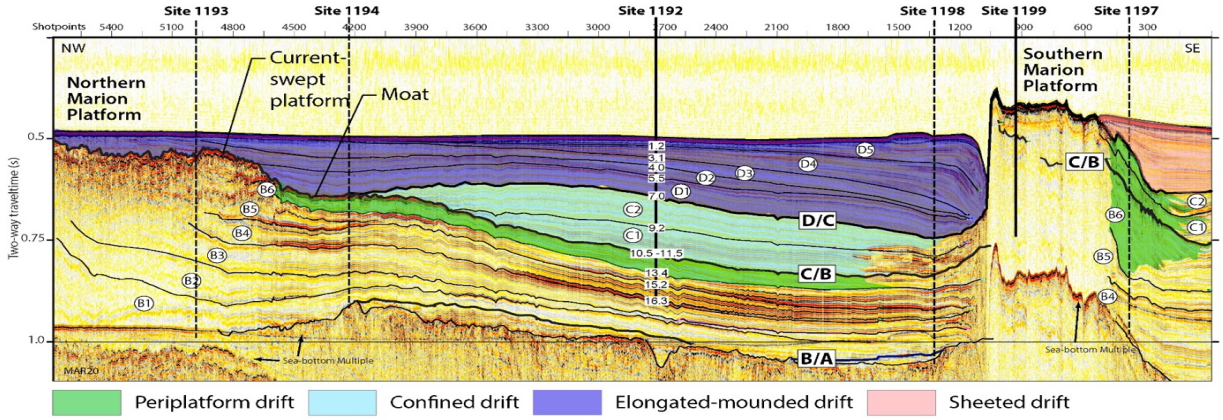

Figure 1: Miocene platforms on the Marion Plateau surrounded by carbonate contourite drifts, illustrating the importance of drift deposition in off-bank areas in the Neogene (from Bashah et al., 2020).

PROJECT PROGRESS AND FUTURE PLANS

For a comprehensive overview of the processes that form carbonate contourite systems, we plan to examine carbonate drifts in various tectonic and depositional settings. In past years, we have described three carbonate-specific types of contourite drifts that develop because of a feedback between steep morphology and sediment production and delivery to the currents (Eberli and Betzler, 2019), and have started to examine the influence of currents on the flank architecture of isolated platforms (Betzler and Eberli, 2019). These studies form the starting point of an evolving data base of carbonate contourite drift systems that includes their dimensions and composition and relates these parameters to the oceanographic setting.

In order to understand the distribution of coarse-grained (potential reservoirs) and fine-grained deposits (seals) within the carbonate drift system, a thorough examination of the depositional processes is needed. These processes will be studied in both the modern and ancient current-controlled settings. A special emphasis will be laid on the conditions that produce supercritical flow and prolonged phases of bedload transport that are likely to produce well-sorted coarse deposits.

Carbonate contourite drift deposits have characteristic log signatures that differ from shallow-water and slope carbonate successions (Giddens et al., 2020). We plan to document and explain these petrophysical properties with laboratory experiments. These results and log data from carbonate drifts will be assembled in a data base.

SIGNIFICANCE

Depositional processes in the off-bank and deep-water areas are the combined product of pelagic fallout, mass gravity flows, and bottom currents. This research will improve the knowledge of the current component on deep water deposition and improve depositional models of slope and ramp carbonates that until recently mostly considered gravity flows to be the main process.

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