PETROPHYSICAL CHARACTERISTICS OF CARBONATE DRIFT DEPOSITS

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PROJECT OBJECTIVES

- Define the specific petrophysical characteristics (porosity, velocity, resistivity and permeability) in plugs and logs of carbonate contourite drifts using data from drifts in the Maldives, Maiella, Australia, and the Bahamas.
- Contrast the petrophysical properties of drift deposits to those of "other carbonates", representing various depositional environments, lithology and composition.
- Investigate the pore structure of fine-grained carbonate drift deposits in search of an explanation for their high resistivity.

PROJECT RATIONALE

Last year we analyzed the petrophysical properties of the Miocene drift deposits in the Maldives and Cretaceous drift strata in the Maiella, both of which represent delta drifts - a newly discovered specific carbonate contourite drift type (Lüdmann et al., 2018; Eberli et al., 2019). These delta drifts are built by prograding lobes, which are typically coarse-grained in their proximal part and finer grained in the distal fringes. In our data set, samples from the Maldives are from fine-grained intervals, while the samples from the Maiella represent the coarse-grained facies of the delta drift.

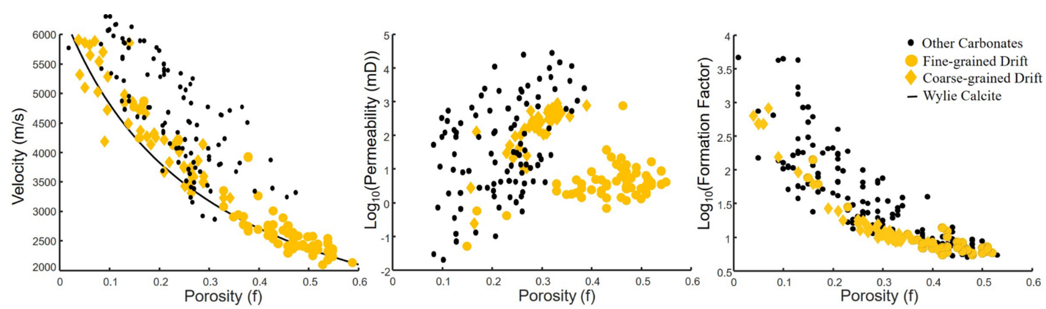

Figure 1: Petrophysical properties of carbonate delta drift deposits (yellow symbols) compared to "other carbonates" from the CSL data base (black dots). Left: Velocity-Porosity plot of drift deposits displaying the small variation exhibited by drift carbonates compared to other carbonates. Middle: Porosity-Permeability plot of drift deposits displaying the separation of coarse and fine-grained deposits. Right: Porosity-Formation Factor (resistivity) plot of drift deposits and 'other carbonates'.

Some characteristics of these two carbonate delta drift deposits are: a) the very high porosity of the coarse-grained facies, which in plugs reaches up to 59%; b) compared to other carbonates velocity and resistivity vary less at any given porosity, and c) permeability separates into two populations according to the grain size (Fig. 1).

This year we will expand the petrophysical investigation to other contourite drifts by analyzing samples from large, separated drift deposits collected during ODP Leg 194 on the Marion Plateau in Australia and the confined drift in the samples cored and logged during ODP Leg 166 in the Bahamas. A plethora of samples of varying age and location are needed for a comprehensive petrophysical description of drift deposits. In addition, we will examine the micropore structure of the fine-grained portion of the drift deposits which display an unusually high resistivity.

WORKPLAN

Velocity, porosity, resistivity and permeability will be measured on plug samples from drifts on the Marion Plateau in Australia and samples from ODP 166 to the Bahamas. Some of the samples have been measured in earlier studies from the Marion Plateau by Guido Bracco Gartner (unpublished) and by Kenter et al. (2002) from the Santaren drift in the Bahamas. These measurements will be combined with new measurements and added to the petrophysical drift deposit database that already contains measurements from the Maldives and the Maiella. In addition, the texture and mineralogy of each sample will be determined, and the pore type of each sample will be analyzed with digital image analysis following the methodology of Weger et al. (2009). SEM imagery will be used to assess the micropore structure.

Log suites from the three contourite drifts drilled during ODP and IODP expeditions will be used to document the log characteristics of the different drift deposits.

GOAL

The goal of the study is to assemble a comprehensive petrophysical database of carbonate contourite drifts, which have the potential to be either underexplored carbonate reservoirs or seals in the petroleum system.

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