PETROPHYSICAL CALIBRATION OF THE COARSE-GRAINED CARBONATE DRIFT FAN, MALDIVES (YEAR 2)

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PROJECT OBJECTIVES

- Comprehensively describe the carbonate drift fan in the Kardiva Channel that includes the sedimentologic characteristics, petrophysical properties, and the seismic signature.
- To reach these goals we will perform the following tasks:
  - Laboratory measurements of porosity, permeability, velocity, and resistivity and relate these properties to the facies, diagenesis, and pore structure of each plug.
  - Measure pore geometries through thin section and SEM analysis.
  - Correlate lithology to logs and seismic data for a thorough calibration of the seismic and log facies of the drift fan.

PROJECT RATIONALE

One of the discoveries of IODP Expedition 359 to the Maldives was that the current deposits in the Kardiva Channel form a drift fan (Fig. 1). The drift origin of the deposits was recognized on the seismic data based on the geometries (Lüdmann et al., 2013), but the cores revealed a facies that has far-reaching implications for interpretations of neritic carbonates. No such system has been reported for carbonates before. Thus, a comprehensive documentation of the lithology, seismic and log facies, as well as diagenesis and petrophysical properties of the drift fan is needed. This documentation will be achieved in a collaborative effort that started with the documentation of the sedimentology and seismic facies by Thomas Lüdmann on behalf of the entire scientific party.

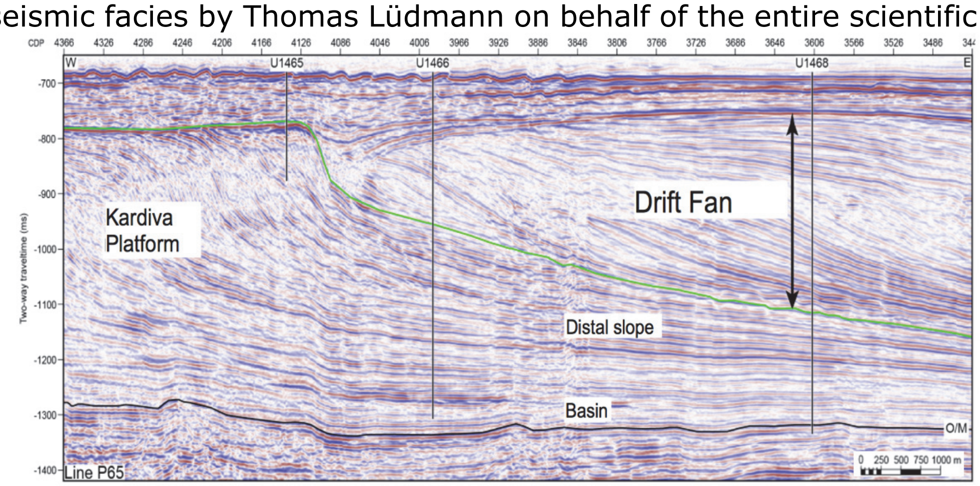

Figure 1. Seismic image of the drift fan in the Kardiva Channel. This unique current-deposited system is a succession of coarse-grained carbonates with high porosity with excellent reservoir qualities.

Scope of Work

The sedimentologic description of the drift fan will rely on core descriptions made by the shipboard scientific party. Laboratory measurements made on core plug samples from these cores will be used to calibrate the petrophysical properties. The core-log correlation will be made in collaboration with Angela Slagle and the seismic correlations with Thomas Lüdmann and Christian Betzler.

For the petrophysical characterization of the contourite fan, we will measure porosity, permeability, velocity, and resistivity. Velocity and resistivity measurements will be conducted under variable pressure conditions to simulate the burial depth of the samples. This data set will be compared to the log data and both will be correlated to the lithologic and seismic facies.

In addition to the laboratory measurements, we will investigate the pore structure with digital image analysis (DIA). The DIA is able to quantify the pore structure that influences both velocity and resistivity variations at any given porosity.

The high porosity of up to 60% in these deposits indicates secondary porosity development. In a related study, the role of celestine formation and dissolution will be investigated as an important process affecting the occlusion and preservation of porosity (see Swart et al., this volume).

The data set will also be compared to the petrophysical characteristics of the drift deposits on the Marion Plateau and the Cretaceous Orfento Formation in the Maiella Mountains. Both laboratory measurements and log data already exist (Ehrenberg et al., 2004; Eberli et al., 2010; Maura, 2013).

Significance

The documentation of this coarse-grained drift fan in carbonates will have major implications for carbonate sedimentology. It is a new sedimentary system that has not been described before. The comprehensive documentation of this carbonate contourite fan will prompt the re-interpretation of deposits with these characteristics, such as neritic shoals or prograding delta lobes. The coarse nature and the high porosity make these deposits potentially an important reservoir facies.

References

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