PETROPHSYICAL CHARACTERISTICS OF CARBONATE DRIFT DEPOSITS – MALDIVES AND IN THE CRETACEOUS MAIELLA MOUNTAINS, ITALY

Emma L. Giddens, Gregor P. Eberli, Luuk Kleipool[1], and Ralf J. Weger
[1)] *Shell Global Solutions International, Rijswijk, The Netherlands*

PROJECT OBJECTIVES

- Delineate distribution and controls on petrophysical properties (porosity, velocity, resistivity and permeability) in coarse-grained carbonate delta drifts.
- Compare petrophysical properties of the Maldives with those in the Maiella mountains, Italy.
- Compare the petrophysical properties of delta drift deposits vs periplatform deposits.

PROJECT RATIONALE

During the last year, we measured the petrophysical properties of the Miocene delta drift in the Maldives that was cored during IODP Expedition 359. The porosity of these delta drift deposits is very high; in plugs porosity varies from 15 – 62%. Velocity also displays large variations from 1.55 – 5.5 km/s. Velocity decreases with increasing amounts of micro-porosity (Fig. 1). Coarse-grained high-porosity intervals exist at the apex of the delta drift. Logs in these uncemented intervals display porosity above 50%. These coarse-grained facies are comparable to the facies in the Cretaceous delta drift in the Maiella Mountains (Eberli et al., 2019). Limited data indicate a porosity range from 5

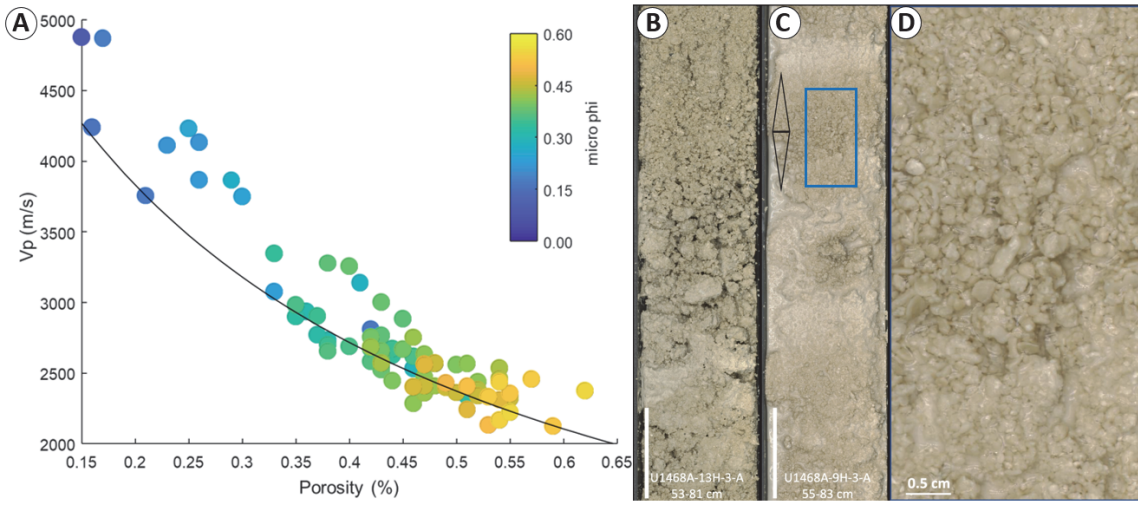

Figure 1: A) Velocity versus porosity plot of the Maldives delta drift sediments with color-coding of micro-porosity, illustrating the influence of micro-porosity on velocity. Right: Core photographs at IODP Site U-1468 located at the apex of the drift delta. B) Graded rudstone with rounded lithoclasts at the base transitioning into skeletal debris. C) Foraminiferal rudstone with thin white intercalations of packstone and a coarsening-fining upward trend. D) Close-up of the rudstone (blue box in C) consisting predominantly of large benthic foraminifera.

– 30% (Fig. 2). Additional samples covering all the facies are needed for a comprehensive petrophysical description of this Cretaceous delta drift. The entire, largely mud-free, bioclastic wedge is a potential reservoir facies. Both delta drifts are deposited on top of (hemi)pelagic strata consisting of periplatform ooze with some turbidites that are expected to be distinctly different from the delta drift facies.

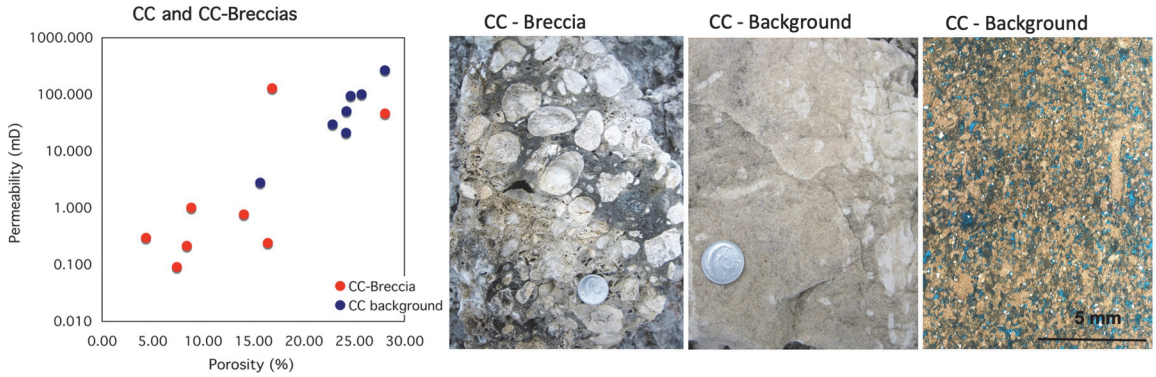

Figure 2: From left: Permeability-Porosity plot of the coarse bioclastic facies (CC) in the mud-free Maiella delta drift. Outcrop Photograph of lithoclasts breccia (coin diameter is 2 cm). Bioturbated rudist grainstone that is the main (background) facies. Photomicrograph of the rudist grainstone facies.

WORKPLAN

The goal of this study is to assemble a comprehensive petrophysical data base of the newly discovered carbonate delta drift in the Maldives that is a potentially underexplored type of carbonate reservoir.

Samples will be collected during the outcrop work planned for the sedimentologic analysis of the different facies belts of the Maiella delta drift. In the laboratory, the same suite of petrophysical properties will be run as were conducted for the petrophysical analysis of the Maldives delta drift. These include porosity, permeability, wet and dry velocity, and resistivity. In addition, 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).

The underlying strata will also be sampled and measured in order to evaluate the differences in petrophysical properties of the two deep-water carbonate successions, for a potential discrimination of these facies.

REFERENCES

Eberli, G.P., Bernoulli, D., Vecsei, A., Anselmetti, F.S., Mutti, M., Della Porta, G., Lüdmann, T., Grasmueck, M. and Sekti, R. (2019) A Cretaceous Carbonate Delta Drift in the Montagna della Maiella, Italy. Sedimentology, 65, online.

Weger R. J, Eberli, G.P., Baechle, G. T., Massaferro, J. L., and Sun, Y.F. (2009) Quantification of pore structure and its effect on sonic velocity and permeability in carbonates. AAPG Bulletin, 93/10, 1-21.