PETROPHYSICAL PROPERTIES AND PORE STRUCTURES IN MICROBIALITES

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PROJECT OBJECTIVES

1. Assemble a comprehensive petrophysical database of microbialites, including stromatolites, travertine, and tufa.
2. Quantify pore structures of microbialites.
3. Correlate pore structures to petrophysical properties and classes of microbialites.

PROJECT RATIONALE

Microbial carbonates are the major reservoir facies in the pre-salt strata of the South Atlantic. No modern setting contains all the varieties of microbialites found in the pre-salt but each modern environment might produce a microbialite with characteristics found in some of the pre-salt population. In addition, microbialites occur throughout the stratigraphic record and several of them can be analogs to the pre-salt varieties. By measuring a variety of modern and ancient microbialites a data set will be created that can be compared to the pre-salt microbialites in regards to their petrophysical behavior and their pore- and frame structures.

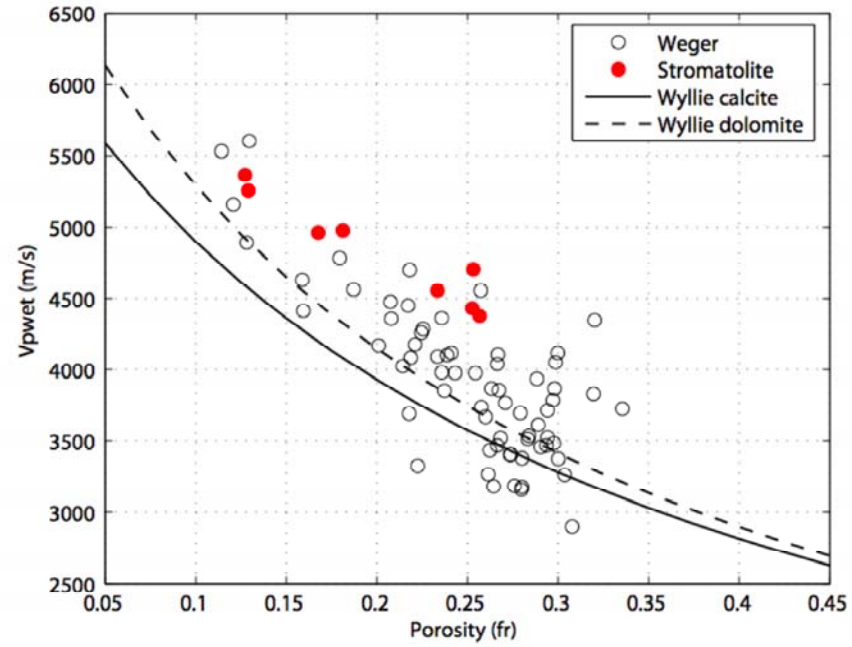

Figure 1. Microbialites, like modern stromatolites, have a great stiffness that is created by microbial processes that weld grains together into a pressure resistant framework. This stiffness is reflected in the high acoustic velocity at a given porosity. In this project we test if the stiffness variations are related to pore structure and grain coupling.

PROJECT DESCRIPTION

This project is a collaboration between the University of Miami and the University of Milano, with both providing samples to the project. The samples consist of travertine, tufa from modern lakes, and modern and ancient stromatolites and other microbialites. The petrophysical measurements include porosity, permeability, acoustic velocity (both dry and brine saturated) and resistivity. The latter will be measured under varying confining pressure. From each sample, a horizontal and a vertical thin section will be cut after the measurements have been made. Petrographic analysis will be used for documenting the texture and the diagenetic overprint, such as cementation and microbial binding. Digital image analysis will provide the quantitative parameters of the pore structures. Together, they are used to explain the physical behavior of the sample.

EXPECTED RESULTS

The correlation between the petrophysical properties and the rock frame and pore structure parameters will shed light on 1) the processes that cause the high stiffness in microbialites, and 2) their behavior under changing pressure and saturation. We expect that different microbialites will show different relationships and consequently some general rules can be formulated for the different varieties of microbialites.