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## **Hydraulic Flow Unit Analysis for Reservoir Characterization in Pre-Salt Carbonates: A Case Study from the Mero Field, Santos Basin**

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## Hydraulic Flow Unit Analysis for Reservoir Characterization in Pre-Salt Carbonates: A Case Study from the Mero Field, Santos Basin

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### Introduction

The pre-salt carbonate rocks in the Santos Basin are of significant value for the study of carbonate reservoirs due to their unique characteristics and the heterogeneity in their relationships between porosity, permeability, petrology, and structural control. However, their complexity makes predicting fluid movement and production behavior challenging. Hydraulic Flow Units (HFUs) are particularly useful in carbonate reservoirs as they help reduce this heterogeneity and enhance the understanding of fluid behavior over time. HFUs are defined as volumes of reservoir rock with similar geological and petrophysical properties, allowing fluids such as water and oil to move similarly through them. This study aims to correlate facies, diagenesis, and reservoir quality in the study area using HFUs.

### Method and/or Theory

The research was conducted on 114 core plugs from a well located in the Mero Field, Santos Basin. Petrographic descriptions of each plug were performed to identify lithology, sedimentary structures, textures, and diagenetic features influencing reservoir quality, and values of porosity and permeability were acquired using Routine Core Analysis (RCAL). The basic petrophysical parameters and lithologic information from vertical and horizontal core plugs were analyzed using the Flow Zone Indicator (FZI) technique, enabling the clustering of samples of similar properties.

### Results and Conclusions

Various post-depositional processes can mask or completely alter the original porosity and permeability characteristics of the rock. Four HFUs were defined for the horizontal plugs and three for the vertical ones, this division was chosen by the minimal number of clusters while maintaining a good correlation coefficient. Scatter plots of absolute permeability versus effective porosity revealed considerable variability in these characteristics within the same lithology. This variability is particularly notable among shrubstones, the most common lithology found, likely due to the influence of several diagenetic processes, such as silicification, commonly observed in the samples. Understanding the relationships between these aspects is crucial in carbonate reservoirs, especially in the pre-salt, due to the unique depositional development.