ESTIMATION OF ADDITIONAL PETROPHYSICAL PARAMETERS USING X-RAY MICROTOMOGRAPHY: AN EXAMPLE OF MORRO DO CHAVES FORMATION

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RESUMO: When dealing with heterogeneous reservoir rocks, frequently porosity and permeability are not enough to understand and characterize the ability of a rock to allow the fluid flow. As commonly seen in carbonate reservoirs, the range of pore and pore throats sizes are very large, meaning that in one single sample we can have both small pores (micropores) and large pores (macropores). Pore types, degree of cementation and grain/matrix content can influence the communication between small and big pores. As can be noted, establishing parameters to assess this complex relationship is of great importance in the O&G industry. In the case of exploration and production, easily accessible pores are important to maximize the recovery factor, as well as if large pores are connected by equally large pore throats it is possible to avoid the snap-off effect. On the other hand, for CO_2 storage purposes, the connectivity of the pore network can impact the entrapment of bubbles, reducing the storage capacity. In order to investigate this complex relationship, we proposed the adoption of the Coordination Number (number of pore throats connecting a pore) and the pore/pore throat ratio, implementing a comparison context to analyze the differences of these parameters in coquinas. To do this, we have acquired a set of microtomographic images of a single spatial resolution (28 µm) at the LMPT/UFSC with an Xradia Versa XRM-500 scanner. After acquiring these images, they were filtered and segmented to separate the porous phase, which was then reconstructed using a Maximal Ball Algorithm (MBA) to simplify the pore network preserving the topological and structural characteristics. Employing this simplified network, Coordination Number (CN) and pore/throat ratio have been computed. We have so far extracted the aforementioned parameters for five samples, which represent four different taphofacies. Coq18 (taphofacies G1/Cfi) have shown a CN of up to 17, but approximately 50% was concentrated between 0 to 1, negatively influencing the average CN which was 1,88. Average pore/pore throat ratio for this sample is 1,58. Coq 9 (taphofacies G3) has a larger range of coordination number (0 to 26) and showed a good percentage (80%) of CN 2 to 7. For this reason, average CN was 3,74. Average pore/pore throat ratio is 1,69. Coq 7 and Coq 10B (taphofacies G4/Cm) demonstrated the existence of a good range of coordination number (Coq 7 - 0 to 25; Coq 10B – 0 to 16) with a reasonable percentage of CN 2 to 5 (Coq 7 - 43%; Coq10B - 40%) with an average CN of 1,63 (Coq 7) and 1,45 (Coq10B). Average pore/pore throat ratio was 1,51 for Coq 7 and 1,70 for Coq 10B. A-16 (taphofacies G5) has also shown a good range of coordination number (0 to 20) with 70% of CN 2 to 7, contributing to an average CN of 2,59. Average pore/pore throat ratio is 1,86. These data revealed some important petrophysical characteristics otherwise inaccessible with traditional methods (thin-sections and experimental methods), proving the usefulness of microtomography. Nevertheless, recent studies confirmed the necessity of a multi-scale approach.

PALAVRAS-CHAVE: petrophysics, Morro do Chaves, microtomography.