Integrated Geological Characterization and Distribution of the Salada Member, La Luna Formation, in the Central Area of the Middle Magdalena Basin, Colombia

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Abstract

La Luna formation has been considered traditionally as the best source rock in northwestern South America (Bralower and Lorente, 2003). In Colombia, La Luna formation is the source rock of the biggest commercial hydrocarbon accumulations in the Tertiary reservoirs of the Middle Magdalena Basin; this formation is constituted by three members, named from base to top the Salada, Pujamana and Galembo (Morales, 1958) and it has been recently considered as a very prospective unconventional shale reservoir. Although both Galembo and Salada members have good characteristics for production as unconventional reservoirs, the Galembo member is absent in some areas of the Middle Magdalena Basin, mainly in the eastern area, due to an Eocene unconformity.

Core description and the analysis thin sections, X-Ray diffraction and Rock-eval pyrolysis samples of the well #1 permitted the classification of the Salada member into eight facies which are rich in carbonate, predominantly in the lower Salada, and rich in quartz, mainly in the upper Salada member, both with low clay content. The geochemical characteristics of these facies suggest that they are good to very good source rocks. TOC content varies from 0.5 to 8.15 wt% and the average is 3.62 wt%. GAMLS software was used to predict those eight facies in the unconred wells #2 and #3.

Analysis of Rock-Eval pyrolysis data indicates a predominance of type II kerogen and suggests an oil-window thermal maturity state for the Salada member, thus showing that oil is the predominant hydrocarbon expected.

Scanning Electron Microscopy analysis showed that porosity is mainly associated with microfractures, intraparticle pores (grains and fossils) and interparticle pores. 64% of total porosity is associated with micropores and the remaining 36% is associated with nanopores.

Well logs, mineralogical composition, TOC content and Relative Hydrocarbon Potential parameters were employed to establish a sequence stratigraphic framework for the Salada member in the well #1 and its subsequent correlation in wells #2 and #3. Five prospective intervals were identified in the Salada member in the well #1 and one of them was correlated throughout the other two wells.