

## **EVIDENCES FOR THE PRESENCE OF A NEW PETROLEUM SYSTEM IN EASTERN-VENEZUELA: PERSPECTIVES FOR FUTURE EXPLORATION**

Carolina C. OLIVARES ANGEL<sup>1</sup>

1. PDVSA, *Exploración y Producción, Gerencia de Exploración, Reexploración. Edificio 5 de Julio, Maracaibo. Edo. Zulia. Venezuela.*

For crude oils (from the South-Central part of the Eastern Venezuela Basin, EVB) three oil seeps (two of them located in The Paría Península region, and the other one towards the north-western side of the Orinoco river) and three reservoir rocks with oil impregnations (Junin Field, Orinoco Heavy Oil Belt) from the EVB, were analysed in this study in order to determine the organic facies, thermal maturity and age of the source rocks that generated them. The purpose is to determine if any of these hydrocarbon occurrences represent a pre-Cretaceous petroleum system in Venezuela. The oil samples were produced from Early Miocene sands, the oil seeps are oozing out through Cretaceous and Quaternary sands, and the reservoir rocks (Sandstones) with oil impregnations are Cambrian in age.

Geologically the study area involves the Espino Graben and part of the Interior Foothills. The Graben is a depression observed by potential methods (Geoterek, 1982) and structurally is limited by the Ruiz-Sabán Fault, toward the North, and the Altamira Fault toward the South. The Urica fault System, together with the Anaco Fault, are one of the main structural patterns affecting the area. There are several wells drilled in the Espino Graben which have penetrated Carboniferous and Jurassic sediments.

Conventional geochemistry, diamondoids, sterane relationship (Talukdar, 2006), together with basin modelling, seismic data and regional geology were used in this evaluation. Results show that there are three genetic families: The oil impregnations (Cambrian) from the Junin Field form a distinctive family based on geochemical data (NDR\* ranging from 0.10-0.18, Dinosterane ratio around 0.38-0.45, and TPP\* between 0.2-0.4%, among others), probably derived from a Late Triassic-Jurassic source rock with type II kerogen containing mixed marine and terrigenous organic matter deposited in marine environment. The oil seeps are another family, probably derived from Jurassic lacustrine source rocks with type II-III kerogen deposited in coastal environments (TPP ratio ranging from 0.6 to 0.85, and 4-Methyl-steranes between 0.2 and 0.8), and finally, the crude oils from South-Central EVB form one genetic family derived from Tertiary source rock, probably the Oligocene interval,

with type III kerogen containing predominantly terrigenous organic matter deposited in fluvio-deltaic system .

Identification of the source for the oil impregnations and the seep oils proposed in this work provides the first geochemical evidence of the existence of a Jurassic Petroleum System in Venezuela. Although the Jurassic interval has been penetrated by few wells in the Espino Graben (Solorzano *et al.*, 2001) and surroundings, and is mainly composed of massive shales representing oxygenated lacustrine facies, it might be possible to find it deposited in those zones of greater burial and appropriate conditions for oil and gas generation. From the Petroleum System point of view an early generation might be inferred as high heat flow that must be associated with the cortical extension during the Graben formation; the reservoir rock facies may vary from fluvial to alluvial fans, the vertical seal might be the lacustrine facies or fluvial sequences and the lateral seal would be the faults that put in contact all these lithologies and environments.

On the basis of these findings, and the geological model (Salazar, 2006) interpreted so far, it is possible to have an oil generation scenario from a Jurassic source rock in the deepest part of the Graben, with important lateral migration updip towards the flanks of it, as well as vertical migration along the faults towards Cambrian sandstones located in the Southeastern part of the Graben with eventual lateral migration towards other Paleozoic reservoirs. This model, combined with structures visualized in the Pre-cretaceous sedimentary column, will generate attractive plays for hydrocarbon exploration in Eastern Venezuela Basin.

## REFERENCES

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\*NDR: 24-Nordiacolestane ratio

\*TPP: C<sub>30</sub> Tetraciclipoliprenoids