

**TIMING, AMOUNT AND TYPE OF GENERATED HYDROCARBONS IN THE PERIJA AREA,
MARACAIBO BASIN, WESTERN VENEZUELA.
L. MOMPART, MARAVEN S.A., CARACAS, VENEZUELA**

The calculation of the maturity and type of generated hydrocarbons is presented in detail for three wells, (CR-3, ALT-19X and TOT-3) in the western part of Maracaibo Basin, Venezuela.

Three potential source rocks are considered:

- a. Machiques Member of the Apon Fm of Aptian Age.
- b. La Luna Fm., the well known source rock in the Maracaibo Basin, ranging Cenomanian-Campanian in age. Both Cretaceous intervals have T.O.C. values of up to 8% in the studied area.
- c. Marcelina Fm., a sequence of coals and coaly shale of Paleocene - Lower Eocene age. These coals and shales have a high hydrogen index and are considered capable of generating both gas and waxy oils.

The geochemical data used are the TOC, RockEval and Vitrinite Reflectance determination of Intevp, a Petróleos de Venezuela subsidiary, (Luis Mompert interpretation) and Chevron (Dr. Huizinga group).

The Perija area has a complex stratigraphy; the age of some of the formations, the thickness of sediments eroded, the timing of the erosion and/or non deposition can be uncertain due in part to changes in sedimentary environments.

The stratigraphic column of the Alturitas 19X well follows the interpretation of Maraven's Perija Group. The key data of Bottom Hole Temperatures and Geothermal gradients are well known uncertainties. In this case the adjusted geothermal gradient map of the Maracaibo Basin by Luis Mompert (Mompert 1993) was used.

In a broad sense, the goal of any modelling exercise is to increase our knowledge of the entire system. The discussions above have provided a thermal-burial-erosional history model which is reasonably consistent with measured data and with our geological and thermal concepts.

Hydrocarbon generation is modeled using kinetic parameters for standard type II and III kerogens taken from work by Lawrence Livermore National Laboratory in the Basin Mod software.

Sensitivity analysis provides a way to determine how much the output from a model or a calculation is altered by changes in input data. Sensitivity analysis is of value because there are inevitably many uncertainties in the input data used for any type of geologic modeling. It was performed a sensitivity analysis in order to increase our confidence in the output data, thus providing an improvement of the geological model.

The calibration of the data is the key point of modelling. Assuming a correct stratigraphy and the values of Vitrinite Reflectance and T. Max, those values were calibrated versus the assumption of heat flow and geothermal gradient. For example, the calibration of the maturity indicators and the actual geothermal gradient (one value for the whole well) in the CR-3 well fits with the exception of too low value of vitrinite reflectance at 3100 m (Mirador measurement was wrongly done in reworked material).

It has been established a North-South maturity trend, given a migration in the La Luna Fm oil window: It is immature in the TOT-3 well area, and starts at the Miocene time while the Paleocene is immature in the ALT-19X area. In the Rosario field, the maturation of La Luna Fm. begins at Eocene time, and condensates were generated from late Miocene time. The maturation of the Eocene-Paleocene Carbonera Fm. corresponds to the top of the oil window in this southern area.

In the CR-3 well (Rosario field) the Cretaceous source rocks have reached both the oil and gas windows (Fig. 1). The oil generation starts at 50 My (Lower Eocene top). The expulsion (calculated at 20% of generated oil) begins at 40 My (in Oligocene time).

The tertiary source rock (Carbonera Formation) enters the oil window at 10 My (Upper Miocene). Only in this area the tertiary sediments are mature for hydrocarbons generation.

It has also been calculated the amount of hydrocarbon generated in form of generated oil barrels/cubic meters of rock vs. time.

These are very important conclusions for the Exploration and Production of the area when the nature and age of the structures have been established.

Reference cited

Mompert, Luis Mapa de Gradientes Geotérmicos Actuales
Informe Interno Maraven, 1993