Geochemical study of compartmentalization in reservoirs of Block V-VI Lamar, Maracaibo Basin, Venezuela.

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Introduction

Geochemistry applied to the study of reservoirs can be used to solve problems, such as, continuity in the reservoir, intervals producer identification, identification of production problems, and the presence of tarmats. (Kaufman, 1990). After the oil is entrapment, it is subjected to secondary processes, both chemical and physical, which can alter the composition of the oil, therefore, the fluid in each compartment will have characteristics which allow to differentiate it from the others. The study using light hydrocarbon fractions (C15-) permit identify these compositional differences acquired in each compartment and know the continuity of a reservoir.

This paper shows the geochemical study of 7 oil samples from wells of Lamar Block V-VI, Maracaibo Basin; with the purpose of verify the level of communication between reservoirs from level the sand C2.

Experimental

The samples were taken from each wellhead, in hermetically sealed vials to preserve lightweight compounds (C15-). For the evaluation of these samples, in order to determine whether or not communication between the reservoirs wells, the following geochemical analyzes were carried out:

Determination of composition saturates aromatics, resins and asphaltenes. A HPLC equipped with a Waters 600 controller, a rotatable 486 nm absorbance detector and 410 differential refractometer was used.

Gas chromatography, saturated fraction (C15+). For this analysis, a saturated hydrocarbon fraction is weighed and diluted with CS2. Then the sample is placed in the automatic injector of chromatograph HP-6890 model, for analysis.

Biomarkers in fractions saturated and aromatic hydrocarbons by GC-MS. saturated and aromatic hydrocarbons fractions are analyzed by gas chromatography coupled with mass spectrometry equipment. Laboratory PDVSA Intevep uses an equipment model HP-6890 computer with a mass selective detector HP-5973 quadrupole MSD.

Chromatography of fraction C15-. Analysis of the light fraction of oil was performed on a HP-6890 chromatograph equipped with a capillary gas column type PNA of 1.05 m, with temperature programming, helium as carrier gas and FID detector (ionization detector flame). The computer has software for the recognition of the peaks corresponding to saturated and aromatic hydrocarbons present in each sample (DHA system: Detailed Analysis Hydrocarbons).

Results and Discussion

The reservoirs studied show oils with API gravities between 23.5 to 26.81° (medium oil), they have a higher proportion of the saturate fraction and they are classified as paraffinic oils. According to the results suggest that biomarkers are oils mature, little altered from a source rock of marine origin.

Analyses in the C15- fraction corresponds to the visual method of polar diagrams, which are calculated using 10 ratios of compounds, which presented the highest standard deviation, which largely differentiates samples from the same population. (Hernández, 2009). Figure 1 shows the polar diagram of crude oil studied, where we can see that the sample from the well VLE-F (blue line) is slightly different from other wells, this sample (VLE-F) had in several analyzes differences compared to the other samples showed less maturity, lower API gravity, and slight compositional differences.

In the dendrogram (Figure 2) is located on one axis, 9 oil samples that are compared with each other, while the other axis is placed Euclidean distance between them. The difference between families is given by a line (“Cut off), which indicates the Euclidean distance from crudes which are considered different. Cut off the analytical location above is considered instrumental error of the method, which was calculated by performing the triplicate analysis of the sample (VLE-C). The second Cut off is considered above analytical Cut off, and taking into consideration the average and standard deviation of triplicate samples.
There are slight compositional variations found by analyzing the fraction C15+ oil Block V-VI Field, differentiate them into two groups, structurally separated by a fault. However, The compositional variations due to the response in the geochemical parameters, could be associated with the formation waters washing the sample VLE-F well.

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References


The dendrogram shows two families of oils, as suggested by the diagram of stars; one family is represented by wells samples VLE-A, VLE-B, VLE-C, VLE-D, E and VLE-G and other family is represented by the well sample VLE-F.

According the structural map at the top of the sand C2, the sample from the well VLE-F is separated by faults of the other wells, suggesting it is in different compartments. Recommended to check more detail the structural and seismic maps to explain this difference. Another explanation could be that the deposits are in the same compartment, but the sample from the well VLE-F, has a small alteration in its composition depth vertical variations.

Conclusions
The results of analysis of C15+ fraction and studied biomarkers in crude Block V-VI Field, suggesting they were generated by a source rock of marine origin, thermally mature.