

Alterations of Venezuelan Crudes due to Biodegradation Processes Measurable by Biomarker Parameters

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Geochemistry studies done in the Tia Juana Field of Maracaibo Basin (West of Venezuela) to optimize the geological model for better production strategies, have shown in this country one of the most severe cases of aerobic biodegradation and water washing at shallower depths. The biodegradation of a crude in the reservoir reduces its quality due to a sequential removal of n-alkanes, isoprenoids and other branched alkanes and, eventually some cyclic alkanes and aromatics, as conditions for microbial oxidation become increasingly favorable. (Reed, 1977; Alexander et al., 1983; Volkman et al., 1983; Connan, 1984; Peters and Moldowan, 1991).

The study of biodegradation required a preview HPLC separation of 53 crude samples (9° to 12 °API) in order to obtain the SARA fractions of each crude, for further biomarker analysis of the saturated fraction by MID-GC-MS using the m/z 177 and m/z 191 ions. The occurrence of the 17 α ,21 β (H)-25-norhopanes for conversion of extended hopanes has been used to rank the extent of biodegradation of the crudes (Peters et al., 1996).

The results have shown a very similar composition of the crudes (fig.1) and also a similar distribution of the extended hopanes C₃₁-C₃₅ (Fig.2), which may indicate the same level of biodegradation and strong possibilities of hydraulic communications in the reservoir. Nevertheless, the correlation between the C₃₅ Hopane Indexes and the 25-Norhopane Ratios has shown differences to classify the crudes (with the personal criteria of the authors) in three levels of biodegradation: "Low" with 25-Norhopane ratios below 55%, "Middle" with ratios between 55% and 70%, and "High" with ratios above 70% (fig.3). This information has been very useful to locate the zones with the best crude qualities within the reservoir.

Crude locations with its classification of biodegradation in the map have shown a clear tendency of microbial attack and/or water washing increasing from east to west of the field (fig.4), tendency that can be related to changes of lithologic facies of the reservoir-rock that control the recharge of the meteoric water. These data have been correlated with the sedimentologic and geostatistical results to optimize the geological model of the Tia Juana Field.

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