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COMPARATIVE STUDY OF NATURAL GAS DATA FROM THE TAMPICO MISANTLA AND VERACRUZ BASINS, MEXICO

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Chemical and isotopic compositions were acquired on 22 gas samples from the Tampico-Misantla Basin (Pánuco Region) and the Veracruz Basin (Papaloapan Region). These data provide information from genesis and evolution of gases.

Hydrocarbons in the Tampico-Misantla basin were generated from shaly limestones from the Upper Jurassic source rocks. The Veracruz Basin produces oil from Middle Cretaceous carbonates in the province known as Córdoba Platform, and gas from the Miocene sands in the Tertiary Basin of Veracruz (Santiago et al., 1984).

The aim of this work is to show the main differences between molecular and isotopic patterns of gas components from these two basins. There are two distinct characteristics of gas components: The relative content of methane in the Tampico-Misantla gases is less than 11% and the ratio of C_1/C_2+C_3 is around 10. The isotopic value of these gases is about -50‰ that reveals a thermogenic origin. In the Veracruz gases, the relative content of methane is from 87 to 99% and the ratio of C_1/C_2+C_3 is very wide, from 7 to 1000. The Veracruz gases, with lighter isotope signatures of methane (<-55‰), could result from the mixture of thermogenic and bacterial gases (Figure 1). To prove a segregation process or an evidence of bacterial contamination, an ethane/propane ratio versus $\delta^{13}C$ of propane diagram is recommended (Prinzhofer et al., 2000).

The gases from Veracruz Basin contain low amounts of CO_2, between 0.11 to 0.64% and a wide interval of isotopic values, between -17 to -57‰; this isotopic segregation could be produced by the migration. In the Tampico-Misantla Basin the isotopic signature of CO_2 is heavier, between –3.35 to -4.43‰, and its relative proportion is very important, around 90%. When the CO_2 volume is very important it comes from an external source to the petroleum system, as the thermal degradation of carbonates caused by the heat generated by igneous intrusions (Hunt, 1979; Hosgörmez et al., 2005). The CO_2 is of organic origin when $\delta^{13}CO_2$ is lighter than -10‰, and it is of inorganic origin when is heavier than -8‰ (Thrasher and Fleet, 1995; Dai, J. X. et al. 1996). In the Tampico-Misantla Basin, igneous rocks occur throughout a large part of the Tampico Embayment. The rocks of Cretaceous and Tertiary age have been intruded by dykes and plugs of basaltic character (Muir, 1936).

The molecular and isotopic signatures of the natural gases from Tampico-Misantla Basin (Pánuco Region) and Veracruz Basin (Papaloapan Region) are very different. Therefore, it could be concluded that the gases of the Tampico-Misantla Basin present the characteristics of thermogenic gases. These gases are very homogeneous implying a single source and a very narrow range of maturity. The gases of this basin were generated from the primary cracking of kerogen, corresponding to an open system, without any evidence of secondary cracking. In the Tampico-Misantla Basin, natural gases contain high amounts of inorganic CO_2. According to its lighter isotopic values, others processes, such as bacterial contamination or segregative migration, may affect to some degree to the Veracruz gases. The gases from Veracruz Basin were generated in a relatively closed system and they contain low amounts of organic CO_2 and show a clear evidence of migration.

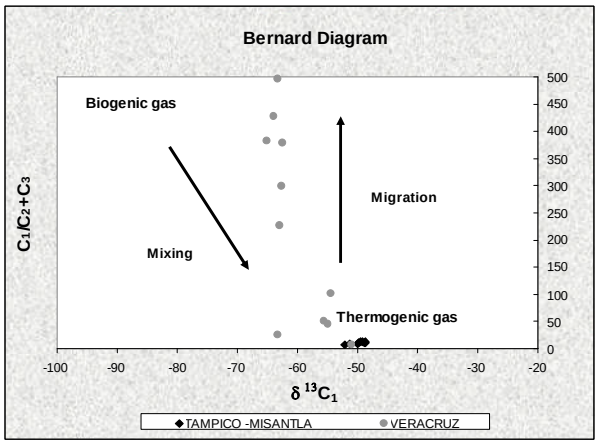

Figure 1. Bernard diagram to classify natural gas using the $\delta^{13}CH_4$ against chemical compositions $C_1/(C_2+C_3)$ of the gases in Veracruz and Tampico-Misantla Basins.

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