

Oil Geochemical Characterization in the Central Part of the Llanos Basin, Colombia

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ABSTRACT

A geochemical characterization of oil samples has been done in the central part of the Llanos Basin in Colombia. Analyses of API, metals (V, Ni and S), isotopes (saturated and aromatic), SARA, gas chromatography (GC) for the whole oil and gas chromatography-mass spectrometry (GC-MS) for saturated and aromatic fractions were applied to approximately forty oil samples to estimate their origin and the alteration processes. Based on the integration of the obtained results, four different hydrocarbon families can be differentiated: Family 1 has 21-30degAPI without any indication of biodegradation. It mainly charged Palaeogene reservoirs of the Carbonera formation, as indicated by the high amount of oleananes. The biomarkers indicate marine deltaic origin with some terrestrial input. This oil family is present everywhere in the central Llanos basin. Family 2 with 12.5-19.5degAPI seems to be the biodegraded product of oil family 1. This oil family is located in the southern part of the central Llanos in the Paleogene reservoirs. Family 3 has 32-40degAPI and is very distinct compared to the previous oil families. It is probably sourced by a marine source rock as the elevated DBT/P values may indicate and has no or only little indications of biodegradation. The producing reservoirs are the Gacheta/Une units (Cretaceous) and located in the southwestern part of the central Llanos. Family 4 (12-14degAPI) is strongly biodegraded. But it still has light components. This is interpreted as an oil mixing process of a biodegraded oil with a fresh oil containing the light components. This oil family 4 is mainly present in the Gacheta/Une reservoirs (Cretaceous) in the northeastern part of the central Llanos. Biomarkers indicate that at least two different source rocks has been deposited: one in a marine and the other in a terrigenous environment. The marine source rock facies is highly likely Cretaceous with some carbonate indicators, while the terrigenous setting may have been present in the Cretaceous and surely is reaching into the Palaeogene. At least two migration pulses of different ages affected the area. This can be concluded by assuming an oil mixing process with high level of maturity dissimilarity in the same reservoir. The strong biodegradation of some reservoirs makes a reconstruction of the petroleum systems in the Llanos very complex.