The Guarumen Subbasin, with an area of about 6800 km², is located in the northwestern region of Venezuela. Few exploratory works have been carried out in the Guarumen Subbasin. The main sedimentary fill of the Subbasin is Cenozoic and evolved tectonically from a phase of extension (Paleocene – Eocene) to a compressive setting (Miocene). Geochemical analysis carried out on samples of two exploratory wells and 1D basin modeling results are presented in this contribution.

Some pelitic sections of the Pagüey Inferior Formation and possibly of the Pagüey Superior Formation are considered as source rocks of the gas discovered in two exploratory wells. The pelitic sections are composed predominantly by non fluorescent amorphous organic matter, interpreted as indicative of type II and, in some cases, II/III kerogens. In some sections the organic matter is dominated by vitrinite particles, suggesting type III kerogens. The levels with type II kerogen are considered as deposited in marine environment, and the levels with type III are composed mainly by continental organic matter. Maturity profiles were constructed with numerous vitrinite measurements for the two wells. The maturity profiles are basically straight, and show that the Pagüey Inferior and Superior Formations are in wet to dry “gas window”.

The main event of generation, expulsion, and migration of hydrocarbons was associated to the emplacement of the tectonic load during the Middle to Late Miocene. In La Doncella 1X well the Pagüey Inferior Formation reached the oil window at the end of the Eocene, due to sedimentary load. However, the principal event was related to the emplacement of thrust sheets (Middle - Late Miocene). Reconstructed eroded thicknesses range from 8000 to 12000 feet. Regional migration pathways were possibly to the south-southeast, due to the emplacement of the allochtonous in the west and northwest.

The recovered gas samples are composed mainly by methane, with values over 95% of the total composition. Based on the compositional and isotopic information the samples represent a dry thermogenic gas of high maturity mixed with a very minor proportion of wet thermogenic gas of lower maturity. It is interpreted that the gas was generated from levels with type II kerogen.

The evidences suggest the presence of a petroleum system Pagüey - Pagüey Inferior (!). The recorded hydrocarbon is gas. The correlation of the source rock levels and the gas is based on the isotopic composition of the gas and the coincidence in the maturity of the source rock and the gas. Reservoir rock is represented by fine to medium quartzose sandstones of the Pagüey Inferior Formation. Matrix porosity of the sandstones range from 3 to 5%, but the quality of the reservoir is conditioned by the quantity and type of fractures. The prospectivity of the subbasin is related to light hydrocarbons, mainly gas.

Keywords: Guarumen Subbasin, Tertiary petroleum system, Pagüey Formation, gas isotopic composition.