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L.E. Navarrete¹, M. Erquiaga¹, B. Fontecha¹, M. A. Torres¹ (1) Repsol-YPF, The Woodlands, TX

Hydrocarbon Gas Potential of The South Andean Foothills, Barinas Basin, Venezuela. The Barrancas Block as An Example

The south Andean foothills of Venezuela (Barinas basin) have long attracted attention as a potential hydrocarbon province due to its paleogeographic connection to the highly prolific Maracaibo basin and La Luna petroleum system (!). Three foothills gas discoveries estimated as 1.6 Tcfg and exploration reserves in excess of 2.3 Tcfg, evidence an important remaining gas potential. Southward, the Barinas basin foreland holds 900 MMBO (EUR). The polyphase foothills structures resulted from Late Jurassic half-grabens reactivated by Eocene thrusting (Caribbean plate emplacement) and Late Miocene - Early Pliocene Andean inversion. Passive margin shallow marine clastic and carbonatic deposits of Albian-Maastrichtian age (Aguardiente, Escandalosa, Quevedo and Burgüita Fms) and foreland basin sediments of Middle Eocene age (Gobernador Fm) conform the objective reservoirs. Severely damaged reservoir primary properties due to quartz overgrowth and calcite cement precipitation were subsequently enhanced by high-density natural fracture generation during the Pliocene inversion. Fractures are opened in sandstones and closed or semi-opened by mineralized bridges in limestones. Porosities and permeabilities range from 2 - 6% (mean 4.5%) and 0.01 - 15 mD, respectively. Although favorable hydrocarbons expulsion and migration occurred since Late Miocene (10 My for oil and 5 My for gas) from an elongated mature hydrocarbon kitchen situated within the Andean foothills, poor petrophysical properties allowed only for gas entrapment. Positive surface geochemistry surveys and analogies with the foothill discoveries support the exploration of the large closures near and within the Andean thrust belt such as the 1.7 Tcfg three ways against fault closure Guaramacal prospect.