Reservoir Properties and Petrology of the Taylor-Navarro Group Sands—Implications for the South Texas Gulfian Petroleum System Framework

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ABSTRACT

Hydrocarbon reservoirs in Maverick Basin and surrounding areas are primarily found in Upper Cretaceous sands within the Taylor and Navarro groups' San Miguel, Olmos, and Escondido formations. These Campanian and Maastrichtian formations comprise mostly fine- to very fine-grained sandstones incased in thick shale intervals. Reservoir quality distribution within these sandstones is heterogeneous and difficult to predict regionally, thus warranting further study. San Miguel and Escondido sands were deposited slowly on a stable shelf environment allowing for reworking by wave and current action, whereas Olmos sands were deposited quickly in fluvial deltas. Regionally, the Rio Grande Embayment clastic sediment provenance has been related to Laramide orogenic belt tectonic activity to the west-northwest, which has been supported by our work.

Four regional well log (gamma ray, spontaneous potential, resistivity, and neutron) cross-sections, oriented in both depositional strike and dip, were qualitatively (e.g. formation tops) and quantitatively (e.g. porosity) interpreted. These sections show the Gulfian sands thinning (with decreased presence) and becoming finer-grained downdip outside Maverick Basin. Within the basin, in thin (tens of feet) net pay intervals, porosity interpreted from logs reaches about 25 percent, and core reports list permeability ranging from single to tens of millidarcys. Historically, porosity is described as intergranular, with spatially variable clay, calcite, and pyrite cements. Regional downdip decreases in porosity may occur due to changing depositional environment from stable shelf to basin floor across syndepositional faulting and/or are due to an increase in cements. Literature suggests this decrease in porosity corresponds to a downdip change from heavy oil charge to dry gas charge, and this is confirmed by our analysis of API gravity and GOR data from production around the basin. Nevertheless,

Buursink, M. L., W. H. Craddock, C. A. Doolan, and M. D. Merrill, 2019, Reservoir properties and petrology of the Taylor-Navarro Group sands—Implications for the south Texas Gulfian petroleum system framework: GeoGulf Transactions, v. 69, p. 477–478.

within Maverick Basin, understanding local reservoir quality and related hydrocarbon charge heterogeneity, which may be related to individual sand deposits, requires ongoing log and petrographic work.