Unconventional Tight Oil Content and Quality of the Upper Jurassic, Onshore Tampico-Misantla Basin, Mexico

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ABSTRACT

Unconventional petroleum systems now play a dominant role in the global supply of petroleum. North America has led the way in the development of these resources, and Mexico stands on the threshold of further impacting the global petroleum supply. The Upper Jurassic source rocks of the onshore Tampico-Misantla Basin (TMB), Mexico are world class, effective source rocks having sourced the bulk of petroleum in Cretaceous and Tertiary reservoirs both onshore and offshore Mexico. These Upper Jurassic source rocks are Tithonian, Kimmeridgian, and Oxfordian in age and identified as the Pimienta, Taman, and Santiago formations. These are coeval with the sources in the Deepwater Gulf of Mexico as well as in the East Texas Basin where Bossier and Haynesville source rocks are productive for shale gas due to their higher thermal maturity. While classical expulsion models promote very high rates of expulsion, retained petroleum accounts for about a third of the generated petroleum in the source rock. This is substantiated in Mexico by the volume of gas flowed from wells drilled in the Burgos Basin, Northeastern Mexico. Two recent wells flowed 10 and 12.2 mmcf/day of natural gas. This can only be explained by a high amount of retained oil that was ultimately cracked to gas. These retention and cracking processes account for shale gas in various North American plays such as the Barnett, Fayetteville, and Marcellus shales. However, volatile oil is targeted in the TMB. Initial criteria for establishing the in situ tight oil producibility of a given source rock are the conversion of oil-prone organic matter of sufficient organic richness as well as its thickness, storage capacity, type and phase of oil (i.e., thermal maturity as related to the kerogen type), permeability, overall areal extent, and its susceptibility to favorable stimulation. In the simplest case a source rock having 2% TOC with a hydrogen index (HI) of 600 mg/g, a thickness of 100 ft, and 80% conversion would have generated approximately one billion barrels of petroleum every 72 square miles. In situ petroleum would represent about 30% of that total and with a 10% recovery over the same acreage, production would yield 300 million barrels of petroleum. However, the U. Jurassic source rocks of Mexico average closer to 4.5% original TOC and over 400 ft in net thickness suggesting much larger in situ petroleum. Costs will be reduced by drilling multiple stacked pay zones in this thick U. Jurassic section.