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Linking the Emerging Mexican Eagle Ford Shale in Burgos Basin with the Eagle Ford in Texas

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Summary

The technical and economic success in the Eagle Ford shale in Texas with horizontal wells and multi-stage hydraulic fracturing jobs and the ongoing reform in Mexico have created high expectations about the development of the well-known shale formation south of the border in Mexico.

Integration of geologic, geochemical, petrophysical and production data is a key for a proper characterization when dealing with unconventional reservoirs. In this study, some of the wells that corroborated continuation of Eagle Ford in Texas and Burgos basin, such as Emergente 1, Habano 1, and Montañés 1 are examined on light of recent advances in the evaluation of shale reservoirs using geoscience and engineering data.

Introduction

Technical and economic success in the Eagle Ford (EF) shale in Texas with horizontal wells and multi-stage hydraulic fracturing jobs, and the ongoing reform in Mexico have created high expectations about the development of the EF south of the border in Mexico.

Exploration of unconventional resources began in northern Mexico in 2010 with well Emergente-1, that corroborated the continuation of the U.S. shale into Mexico. By 2012, three more wells had been completed in the Mexican EF shale, Nómada-1, Montañés-1 and Habano-1, which were non-productive, non-commercial, and gas-condensate producer, respectively.

Theory and Methods

Integration of geologic, geochemical, petrophysical and production data is key for proper characterization of shale reservoirs.

The geologic continuity of the Texas EF shale into Mexico was corroborated with seismic profiles and geologic cross sections. Assessment of the Mexican source rock quality was carried with Rock-Eval Pyrolysis data, ranking the Mexican EF source rock as excellent, with a kerogen type II-III, indicating oil to gas prone. Well log interpretation was carried out in terms of modified Pickett plots that linked Mexican EF results to those obtained in the EF shale of Texas as shown in ***Figure 1***. The graph includes lines of constant water saturation, flow units (relative value of permeability over porosity ratio), Knudsen number, and Bulk Volume Water (BVW). FUA is the flow unit with the best characteristics of porosity and permeability (Lopez and Aguilera, 2016). Comparison of geochemical and petrophysical parameters in North American shales (***Tables 1 and 2***) highlight the excellent potential of Mexican shales.

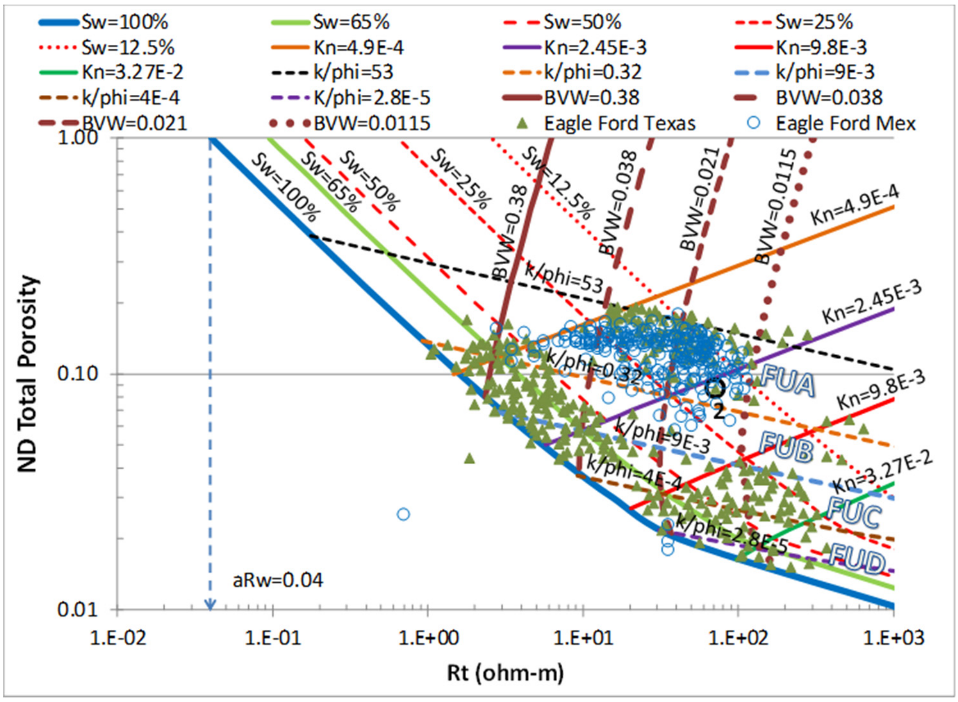

Figure 1 *Modified Pickett plot for EF shales in the U.S. (green triangles) and Mexico (blue circles). There are several hard-to-notice green triangles under the blue circles in flow unit FUA.*

Finally, analysis of production data was completed with the use of specialized plots. Long transient linear flow periods are happening in EF Mexican shales without reaching boundary dominated flow.

For example, the 62 months of production of well Emergente-1 analyzed as a simple crossplot of 1/q vs. the square root of time, indicate continuous linear flow (Cruz *et al*., 2016).

Table 1 *Comparison of Mexican and U.S. shales geochemical parameters.*

	U.S. Shales (Maende et al., 2013)	Eagle Ford Mexico (This work)	U.S. Shales (Maende et al., 2013)	Pimienta Mexico (This work)
Resource System:	Shale gas	Shale gas	Shale oil	Shale oil
Age:	Devonian-Up. Cretaceous	Upper Cretaceous	Devonian-Miocene	Upper Jurassic
Tmax (°C):	> 455	506	435 - 465	450
TOC_{pd} (wt %):	1 - 5	4.74	0.1 - 15	2.88
HI_{pd} (mg Hc/g TOC):	10 - 80	38	50-620	150
Ro (%)	1.2 - 2.5	1.66	0.6 - 1.3	0.85

Table 2 *Comparison of Mexican and U.S. shales petrophysical parameter.*

	U.S. Shales (Jarvie, 2012a)	Eagle Ford Mexico (This work)	U.S. Shales, Haynesville (Gilbert, 2009)	Pimienta Mexico (This work)
Resource System:	Shale gas	Shale gas	Shale oil	Shale oil
Age:	Devonian-Up. Cretaceous	Upper Cretaceous	Devonian-Miocene	Upper Jurassic
Gross thickness (ft):	50 – 1,500	150	>1,000	460
Net thickness (ft):	50 - 700	106	200-300	262
Porosity (%):	1 - 14	12	4-15	13
Permeability (nD):	0 – 5,000	80 -340	> 100	2.5 – 4,600
Oil saturation (%):	< 1 - 15	3.85	> 5	75
Water saturation (%):	13-30	25	15-20	17

Conclusions

It is concluded that the Mexican potential in the EF shale can mimic the results obtained in Texas (similar for Pimienta shale). If Mexico takes advantage of the Texas learning curve, the future of the Mexican Eagle Ford shale will certainly be outstanding. The first stages of the Mexican development have been initiated, but significant investment is needed to continue the exploitation of the unconventional fields.

Acknowledgements

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References

Cruz, M., *et al*. 2016. Mexican Unconventional Plays: Geoscience, Endowment and Economic Considerations. SPE 2460927, Unconventional Resources Technology Conference, San Antonio, Texas, 1-3 August 2016.

Lopez Jimenez, B. A. and Aguilera, R. 2016. Flow Units in Shale Condensate Reservoirs. SPE Res Eval & Eng 19 (3): 450-465. SPE-178619-PA.