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# Identification and Characteristics of Tight Oil & Gas Reservoirs; Central Portion of the Chicontepec Formation

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## Summary

Unconventional resources are important for exploration and production in Mexico. The Formation Chicontepec is considered unconventional tight oil & gas reservoirs. The tight reservoirs (TR) are called like that for their low permeability and porosity by petroleum and petrophysical field.

This paper provide a research about concepts, classification, physical properties and petrophysical characteristics of TR, Identification of TR with cores and well logs, geological occurrence and sedimentary characteristics of unconventional tight reservoir in Mexico.

Tight oil must not be confused with shale oil & gas, because they varied through API gravity, viscosity of fluids, extraction method and other aspects.

Reservoirs connectivity is a modifying attribute, usually limited and discontinuous; for these reason, the stratigraphic correlation is discontinuous, because its heterogeneity.

The Production cost is closed to economic limit and sometimes is overtaked.

Well electrical logs are limited by their vertical resolution in these reservoirs; the only exception is the micro-resistivity image log.

In future studies, is appropriated use equations and inversion models of well logs focus on TR.

## Introduction

The Unconventional Resources (UR) are important for exploration and production in Mexico. The tight reservoirs (TR) are defined in this way due to their low permeability and porosity by the petroleum industry. The Chicontepec Formation, eastern onshore Mexico, is considered an unconventional tight oil & gas reservoir.

The objective of this work is providing a description, identification and characterization of tight unconventional reservoirs in Mexico focusing on the Chicontepec Formation.

Even though there are different G&G works in the area, The Chicontepec paleocanyon was treated as a TR just recently.

The workflow activities for the project described in this paper included: research about concepts, classification of unconventional reservoirs in Mexico, physical properties and petrophysical characteristics of the Chicontepec Formation as a TR, and then core and well log analysis to determine its geological occurrence and sedimentary characteristics.
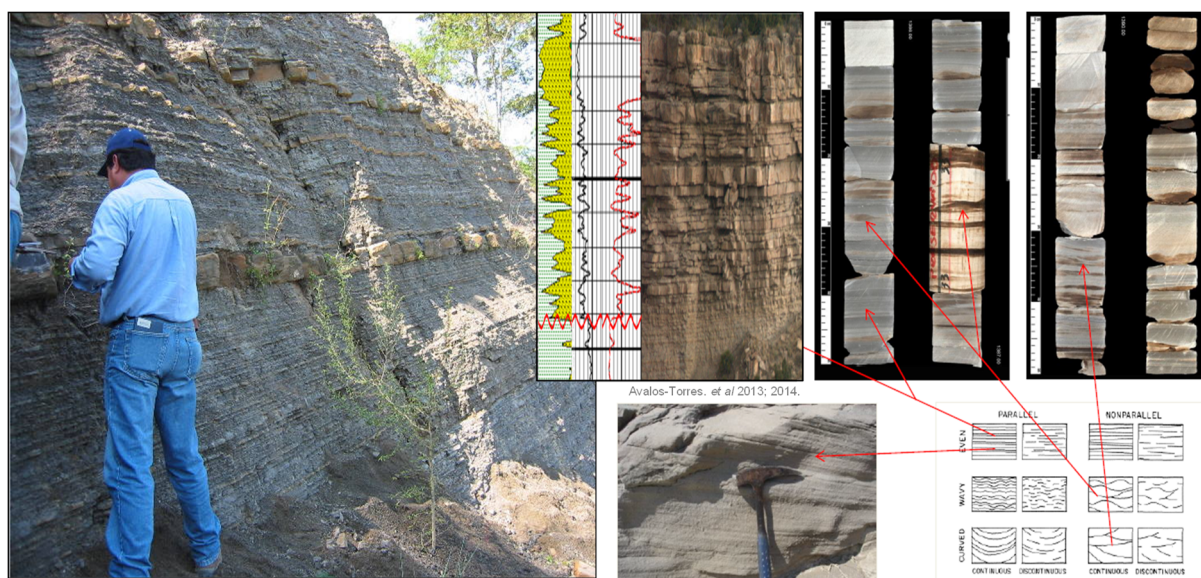


*Figure 1* *Chicontepec Formation presents high stratification of thin and laminar layers often cemented by clay and calcite. Therefore, understanding the clay distribution and mineral component of matrix are remarkable in clay volume estimation (Vcl). A parameter related to porosity, water saturation, permeability, and fluids calculation.*

## Results

The Chicontepec paleocanyon was described as a TR, with concepts, definition, classification, physical properties and its petroleum geology implications.

A detailed analysis with cores, well logs and their analogy with outcrops, was developed in order to obtain a better conceptualization of this TR from the petrophysical point of view.

Reservoir connectivity is usually limited and discontinuous; for this reason, the stratigraphic correlation is also discontinuous, because of this heterogeneity.

Electrical well logs are limited by their vertical resolution in these reservoirs; the only exception is the micro-resistivity image log.
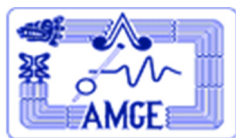
## Conclusions / recommendations

Sandstones deposits analyzed, are considered an UR, type TR, due to their low permeability (less than 1 mD). They are classified as tight sandstones with oil and gas production (tight oil and gas sandstones).

The TR cores and outcrops are fine sandstones formations of marine origin, with primary porosities lower than 10-12% and permeability's lower than 1.0 mD for oil and 0.1 mD for gas.

Physical aspects such as low permeability, connectivity, lateral correlation and hydrocarbon type, sometimes prevent a more encouraging and long-term production.

Cores and geophysical logs and outcrops observations, shows a high degree stratification formations of thin layers and lamination associated with TR. TR can be found in different environments of lithological deposits with a high degree stratification.

The special tools mentioned here, such as Micro-resistivity, triaxial (Rv and Rh) logs and magnetic resonance images, helped to determine sedimentary reservoir characteristics.

The vertical basic logs resolution will always be present, it is an incompetent measurement against these formations. Therefore to major accuracy on petrophysical evaluations, it is advisable to focused on TR equations and log inversion models.

## Aknowledgements

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## References

Aguayo-Camargo, J.E., 2008, Petrología, diagénesis y origen de la porosidad de las facies turbidíticas en el noroeste de la paleocuenca terciaria de Chicontepec, SW de San Luis Potosí y NE de Hidalgo, México (resumen- presentación), en Congreso Anual de la SGM, Ciudad de México.

Aguayo-Camargo, J.E., 2006, Complejos Sedimentarios Turbidíticos (resumen-presentación), en 1er. Congreso Mexicano del Petróleo: Cancún, Quintana Roo, México, Asociación de Ingenieros Petroleros de México, A.C. en coordinación con CIPMAC, AMGEAC, AMGPAC y la SPE.

Avalos-Torres, H., 2013, Petrofísica en yacimientos compactos en la porción central del paleocanal de Chicontepec, Centro-Oriente de México: México, D.F., UNAM., Tesis Maestría, 160 p.

Campbell-V, C., 1967, Lamina, laminaset, bed and bedset: Sedimentology 8, Elsevier Publishing Company, Ambsterdam. Primted in the Neatherlands, 7-26.

Cossey, S.P.J., 2007, Reservoir facies, erosional channels and mass trasport complexes of the Chicontepec formation, Eastern Mexico. Guide book, preparado para PEMEX: Durango, Colorado, USA, Cossey & Associates Inc., 27 p.

Holdich-Stephen., 2007, Unconventional gas, working document of the National Petroleum Council (NPC): Global Oil and Gas Study, Topic paper # 29.

Holdich-Stephen. 2001. The increasing role of unconventional reservories in the future of the oil and gas bussines (presentation): SPE. Schlumberguer.

Méndez-de León., J., 2013, Evaluación petrofísica con registros de alta resolución, una metodología para incrementar la estimación de net pay en yacimientos siliciclásticos laminares (articulo), en Congreso Mexicano del petróleo, Cancun, Quintana Roo, México., pp. 9.
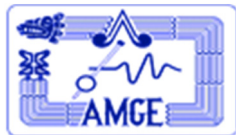
Méndez-de León., J., 2014, Metodología de análisis petrofísico para un yacimiento No Convencional tipo shale gas/oil (articulo), en Congreso Mexicano del petróleo, Acapulco, Gro., México., pp. 20.

Passey-Quinn, R., *et al* 2006, Petrophysical evaluation of hydrocarbon porethickness in thinly bedded clastic reservoir: AAPG, Archie Series No. 1. Tulsa, Ok.

Salazar, Kenia., 2008, Yacimientos compactos Tight. En utel.edu.mx/Licenciaturas; (en línea), en Comunidad Petrolera, disponible en <http://simulacion-deyacimientos.blogspot.com/2008/02/yacimientos-gas-con-baja.html>, consultado 10 de julio de 2011.

Sánchez-Ramírez, J.A. *et al*, 2010, Field examples of combined petrophysical inversion of gamma-ray, density and resistivity logs acquired in thinly bedded clastic rocks formations: Petrophysics, Vol. 51, No. 4, 247-263.

Zhipen-Liu., *et al* 2007, Joint inversion of density and resistivity logs for the improved petrophysical assessment of thinly-bedded clastic rocks formations (paper), in SPWLA 48th Annual Logging Symposium:  Austin, Texas, United States, June 3-6.