The Mancos Shale in the Southeastern San Juan Basin: A Play Limited by Structure and Associated Thermal Maturity*

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Search and Discovery Article #11273 (2019)**
Posted December 16, 2019

*Adapted from oral presentation given at 2019 AAPG Rocky Mountain Section Meeting, Cheyenne, Wyoming, September 15-18, 2019
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Abstract

Oil has been produced from northwestern Sandoval County at the southeastern end of the San Juan Basin since the 1950’s. Cumulative production is 19.2 MMBO. The Mancos Shale (Upper Cretaceous) is the primary producing unit. Most Mancos oil has been produced from the Mancos C zone at the base of the Upper Mancos Shale. Horizontal drilling in the Mancos C caused a resurgence in production from 69.5 MBO in 2011 to 2.1 MMBO in 2015. The Mancos C is 400 to 600 ft thick. Productive reservoir intervals are laminations and thin beds of fine-grained marine shelf sandstones intercalated with kerogen-rich marine shales. TOC of the shales varies from 1 to 3% and generally increases in a northeast, offshore direction. Oil-prone kerogens dominate. In far northwestern Sandoval County where the Mancos C is 5400 ft deep, production has been established in 150 wells. Ro varies from 0.85 to 1.04%. The Mancos C is at peak oil generation throughout most of this area. Depth to Mancos C is approximately 5400 ft in this area and the Mancos C is 400 to 600 ft thick. Southeastward as the Mancos C rises out of the basin, thermal maturity decreases. The Mancos C is immature near its outcrop in central Sandoval County. The southeast limit of Mancos C production coincides roughly with the transition from the lower the upper oil windows. Production is scattered in areas where peak oil generation has not been attained.
The Mancos Shale in the Southeastern San Juan Basin: A play limited by structure and associated thermal maturity

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Outline of talk

• Purpose of research
• General geologic framework
• Production history, oil & gas – Mancos contributions
• Production & petroleum geology of Mancos Shale
• Summary
Purpose of Project

A proposed exploratory well intended to test the Mancos Shale near the city of Rio Rancho in south-central Sandoval County raised concerns among citizens groups about the effects of possible drilling and oil production of scarce groundwater supplies in the region. The Sandoval County Planning and Zoning Dept. and the County Commission requisitioned this study of Sandoval County to determine the potential for oil resources, and therefore possible production as well as potential environmental impacts of production on groundwater aquifers. This presentation focuses on the resource potential.
Sandoval County Oil Production

Annual oil production, MMBO

Year

Samuel Gary Oil Producers
No. 16 San Isidro 11
Sec. 11 T20N R3W
Sandoval Co., NM
Rio Puerco Mancos oil pool

Gamma ray

Resistivity

Open-hole completion
IPF 500 BOPD + 277 MCFD

Upper Mancos oil production
Mesa Petroleum
No. 5 South Blanco 25 Fed.
Sec. 25 T24N R8W
San Juan Co., NM
Lybrook Gallup oil pool

Gamma ray

Resistivity

Mancos B

Mancos C

IP 55 BOPD
+110 MCFD

Tocito ss

Tocito ss

True Gallup

Upper Carlile

[Diagram of geological sections and core samples]

[Map indicating location and reservoirs]
Mancos C @ 5994 ft

Thermal maturation Mancos C
Getty No. 20E Jicarilla B well
Sec. 31, T25N, R5W, Rio Arriba County, NM

Increasing temperature & time

Vitrinite Reflectance

Thermal Alteration Index

Rock Eval TMAX

Biogenic methane
Wet gas (ethane, propane, butane, etc.)
Oil
Dry gas (methane)

Peak oil generation
Mancos C @ 2804 ft

Thermal maturation Mancos C
Dunigan No. 1 Santa Fe well
Sec. 31, T19N, R5W, McKinley County, NM

- Increasing temperature & time
- Vitrinite Reflectance
- Thermal Alteration Index
- Rock Eval TMAX
- Biogenic methane
- Wet gas (ethane, propane, butane, etc.)
- Oil
- Dry gas (methane)
- Peak oil generation

Dunigan #1 Santa Fe

Map showing the location of Dunigan #1 Santa Fe and the thermal maturation of the Mancos C formation.
Thermal maturation Mancos C
Shell No. 41 Wright well
Sec. 26, T17N, R3W, Sandoval County, NM

Increasing temperature & time

Vitrinite Reflectance

Thermal Alteration Index

Rock Eval TMAX

- Biogenic methane
- Wet gas (ethane, propane, butane, etc.)
- Oil
- Dry gas (methane)

Peak oil generation

Mancos C @ 972 ft
Mancos C Thermal Maturity

Vitrinite Reflectance

immature

upper oil window

lower oil window

10 miles
Summary

• In southeast San Juan Basin, strata are abruptly terminated to east by high-angle faults that form mountain ranges
• On the southeast into Sandoval County strata gradually rise to surface where they are truncated by erosion
• Production of oil and associated gas revitalized since 2012 by horizontal drilling in Mancos Shale
• The Mancos C zone of the Upper Mancos Shale dominates Mancos production and has been the object of recent horizontal drilling
Summary (cont’d)

• Mancos C sands in southeast San Juan Basin are finer grained and more bioturbated than Tocito sands to northwest, resulting in poorer reservoirs that inhibit migration
• Limits of oil accumulations on the southeast are controlled primarily by thermal maturity
• Thermal maturity is controlled by depth of burial with Mancos shales mature and productive to northwest and immature and nonproductive where they rise out of the basin to the southeast
Acknowledgements

• Sandoval County Planning & Zoning Department for providing funding
• Mr. Mike Springfield, Director of Sandoval County Planning & Zoning Department
• Dr. Alex Rinehart, NM Bureau of Geology, who worked on environmental aspects of possible future drilling
• Brigitte Felix, NM Bureau of Geology, for GIS support
• Dr. Van Romero & Dr. Dan Fine of New Mexico Tech for facilitating contact with the county