



**dig**  
Dolan Integration Group

## Geochemistry for Energy

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Boulder, CO 80301  
p: 303.531.2030

### Hydrocarbon Gas Composition and Stable Isotopes Data and Interpretation

**Job #:** 16090705  
**Lab #:** DIG-009709  
**Client:** COGCC  
**Sample Name(s):** MC Farms 277080

# Analytical Report



Job #: 16090705  
 Lab #: DIG-009709  
 Client: COGCC  
 Sample Name: MC Farms 277080  
 Date Sampled: 09/20/16  
 Time Sampled: 1.:20  
 Sample Description: Water  
 Sampling Notes:  
 Date Received: 09/21/16  
 Date Analyzed: Gas Composition: 9/22/16  
 Date Reported: 10/25/16  
 Comments: Headspace created with UHP Helium

Measured Values:	Measured ppm	Analyte mol % <sup>a</sup>	HC mol %	$\delta^{13}\text{C}$ ‰ VPDB	$\delta\text{D}$ ‰ VSMOW	Comments
Nitrogen (N <sub>2</sub> )	430687	82.86	-	-	-	
Oxygen + Argon (O <sub>2</sub> +Ar)	85627	16.47	-	-	-	
Carbon Dioxide (CO <sub>2</sub> )	3462	0.67	-	-	-	
Helium (He) <sup>b</sup>	na	na	-	-	-	Added Headspace
Hydrogen (H <sub>2</sub> )	nd	nd	-	-	-	
Methane (CH <sub>4</sub> )	31	0.01	100.00	na	na	
Ethane (C <sub>2</sub> H <sub>6</sub> )	nd	nd	nd	nd	-	
Propane (C <sub>3</sub> H <sub>8</sub> )	nd	nd	nd	nd	-	
iso-Butane (C <sub>4</sub> H <sub>10</sub> )	nd	nd	nd	nd	-	
n-Butane (C <sub>4</sub> H <sub>10</sub> )	nd	nd	nd	nd	-	
iso-Pentane (C <sub>5</sub> H <sub>12</sub> )	nd	nd	nd	nd	-	
n-Pentane (C <sub>5</sub> H <sub>12</sub> )	nd	nd	nd	nd	-	
Hexanes + (C <sub>6</sub> H <sub>14</sub> )	nd	nd	nd	nd	-	

Calculated Values:	
Total HCs (ppm)	31
Gas Wetness (mol % C <sub>2</sub> +C <sub>1</sub> +) )	0.00
C <sub>1</sub> /(C <sub>2</sub> +C <sub>3</sub> ) (mol/mol)	#DIV/0!

<sup>a</sup> Analyte concentrations normalized to 100% (Mol. % is approximately equal to Vol. % )

<sup>b</sup> Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

HC= Hydrocarbons

nd = not detected

na = not analyzed

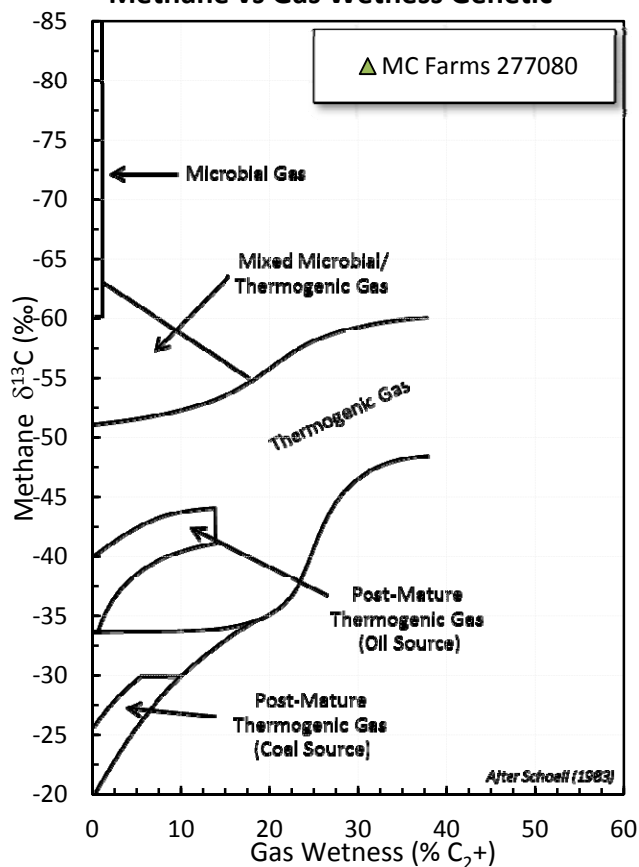
Stable isotope results based on multi-point laboratory calibration

Error  $\delta^{13}\text{C}$  < 0.5 ‰

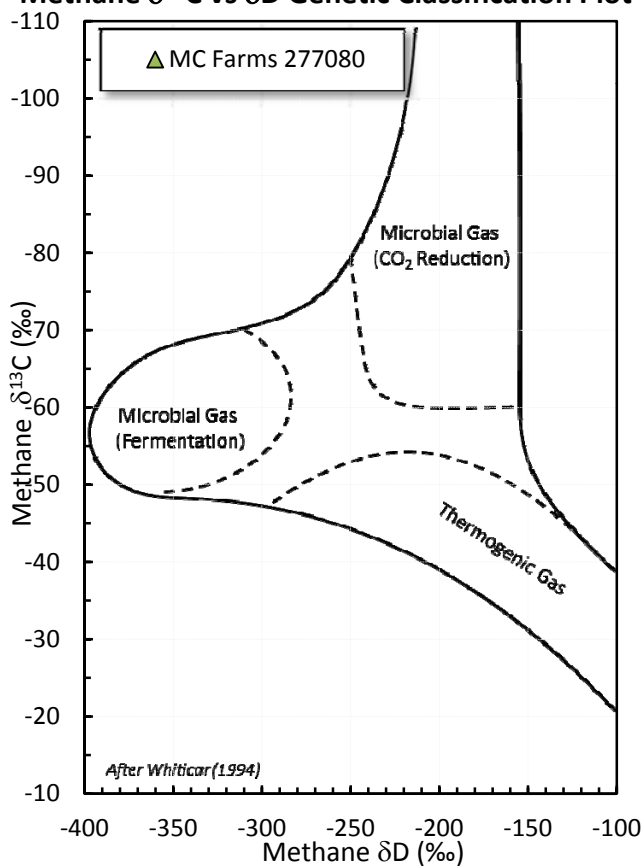
Error  $\delta\text{D}$  < 5.0 ‰

# Stable Isotope Interpretive Plots

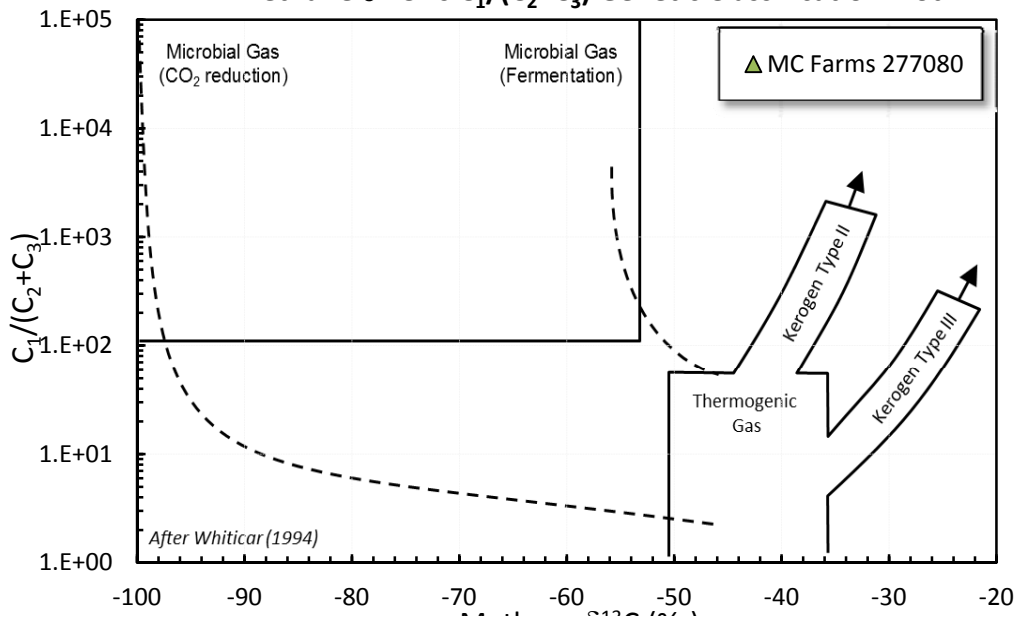
**Methane vs Gas Wetness Genetic**



**Methane  $\delta^{13}\text{C}$  vs  $\delta\text{D}$  Genetic Classification Plot**



**Methane  $\delta^{13}\text{C}$  vs  $\text{C}_1/(\text{C}_2+\text{C}_3)$  Genetic Classification Plot**



# Chain of Custody Form



Geochemistry for Energy

1317 West 121<sup>st</sup> Ave  
Westminster, CO 80234  
p: 303.531.2030

JOS 16090705  
DIG - 009409  
DIG - 009712  
DIG - 009715

## Send Data and Invoice to:

Name: Rick Allison  
Company: COGCC  
Address: 1120 Lincoln Street, #801  
Denver, CO. 80203  
Phone: 970-461-2970  
Fax: \_\_\_\_\_  
Email: rick.allison@state.co.us

AFE #: \_\_\_\_\_  
Report Ctr: \_\_\_\_\_  
Project: 076 Upper Pierre WQ  
PO #: CT2017-734  
Location: 11699301  
Sampled By: JAF

## Sample Description

Container #	Sample Identification	Date Sampled	Time	Analysis Requested						Comments
				Gas Composition* N <sub>2</sub> , O <sub>2</sub> , CO <sub>2</sub> , He, H <sub>2</sub> , C <sub>2</sub> , C <sub>3</sub> +	RSK-175* (Gas composition) N <sub>2</sub> , O <sub>2</sub> , CO <sub>2</sub> , He, H <sub>2</sub> , C <sub>2</sub> , C <sub>3</sub> +, with dissolved C <sub>2</sub> , C <sub>3</sub> & C <sub>3</sub> +	g <sup>18</sup> C Methane (Carbon)	g <sup>2</sup> H Methane (Hydrogen)	g <sup>13</sup> C Ethane-Pentane (C <sub>2</sub> -C <sub>5</sub> if present)		
	MC Farms 27080	9/20/16	1320	✓		✓	✓			Stable Isotopes of Water
										dC13 of Dissolved Inorganic Carbon

## Chain-of-Custody Record

Signature	Company	Date	Time
Relinquished by <u>[Signature]</u>	Pinon	9/21/16	0800
Received by <u>[Signature]</u>	DIG	9/21/16	1300
Relinquished by			
Received by			

\*Gas composition vs RSK-175- Gas composition is a basic analysis of the concentration (ppm) of gases within the headspace of the sample (headspace is created at the lab). RSK-175 is a specific analysis technique combined with calculations to give the total dissolved gas of each species in the water sample (mg/L).

Why one or the other? Gas composition gives us a quick, general look at relative concentrations and ratios (e.g., gas wetness). RSK-175 gives us an exact total of gas present in the sample (headspace and dissolved in the water). Questions? Give us a call at 303-531-2030