Geochemistry for Energy
11025 Dover Street Unit 800
Westminster, CO 80021
ph 303.531.2030

Hydrocarbon Gas Composition and Stable Isotopes
Data and Interpretation

Job #:	**20033693**
Lab #:	**DIG-022410**
Client:	**Origins Laboratory**
Sample Name(s):	**MORALES 0248601**

Analytical Report

Job #:	20033693
Lab #:	DIG-022410
Client:	Origins Laboratory
Sample Name:	MORALES 0248601
Date Sampled:	03/11/20
Time Sampled:	10:00
Sample Description:	1L DIG Bottle
Sampling Notes:	
Date Received:	03/20/20
Date Analyzed:	Gas Composition: 3/24/20 $\delta^{13}C$: 3/27/20 δD: 3/26/20
Date Reported:	04/03/20
Comments:	

Measured Values:	Measured ppm	Analyte mol %[a]	HC mol %	$\delta^{13}C$ ‰ VPDB	δD ‰ VSMOW	Comments
Nitrogen (N_2)	106480	17.90	-	-	-	
Oxygen + Argon (O_2+Ar)	15665	2.63	-	-	-	
Carbon Dioxide (CO_2)	643	0.11	-	-	-	
Helium (He)[b]	na	na	-	-	-	Helium added to create headspace.
Hydrogen (H_2)	nd	nd	-	-	-	
Methane (CH_4)	396314	66.62	83.95	-53.9	-266	
Ethane (C_2H_6)	46567	7.83	9.86	-	-	
Ethene (C_2H_4)	nd	nd	nd	-	-	
Propane (C_3H_8)	20413	3.43	4.32	-	-	
iso-Butane (C_4H_{10})	2518	0.42	0.53	-	-	
n-Butane (C_4H_{10})	4264	0.72	0.90	-	-	
iso-Pentane (C_5H_{12})	867	0.15	0.18	-	-	
n-Pentane (C_5H_{12})	724	0.12	0.15	-	-	
Hexanes + (C_6H_{14})	389	0.07	0.08	-	-	

Calculated Values:	
Total HCs (ppm)	472056
Gas Wetness (mol % C_2+/C_1+)	16.05
$C_1/(C_2+C_3)$ (mol/mol)	6

[a] Analyte concentrations normalized to 100% (Mol. % is approximately equal to Vol. %)

[b] 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

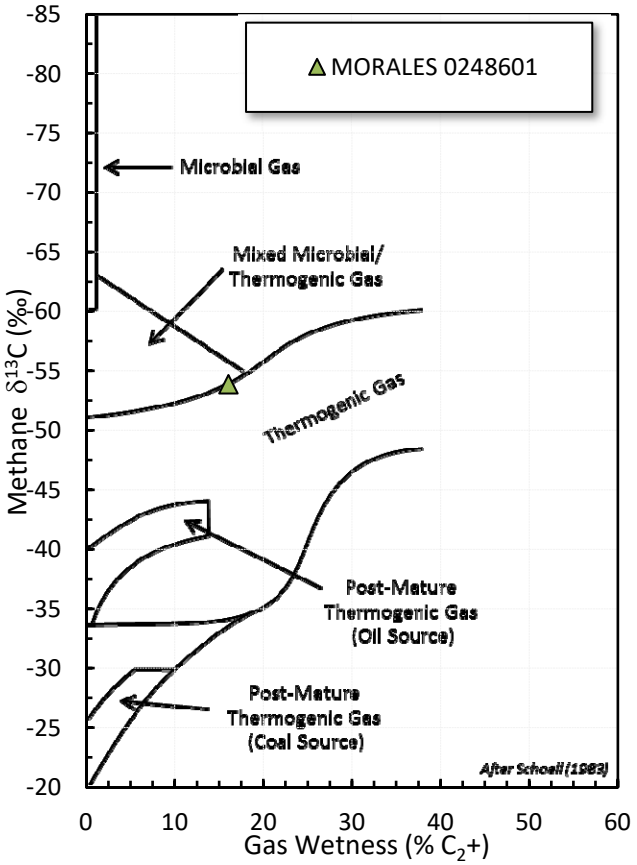
Stable isotope results based on multi-point laboratory calibration

Error $\delta^{13}C$ < 0.5 ‰

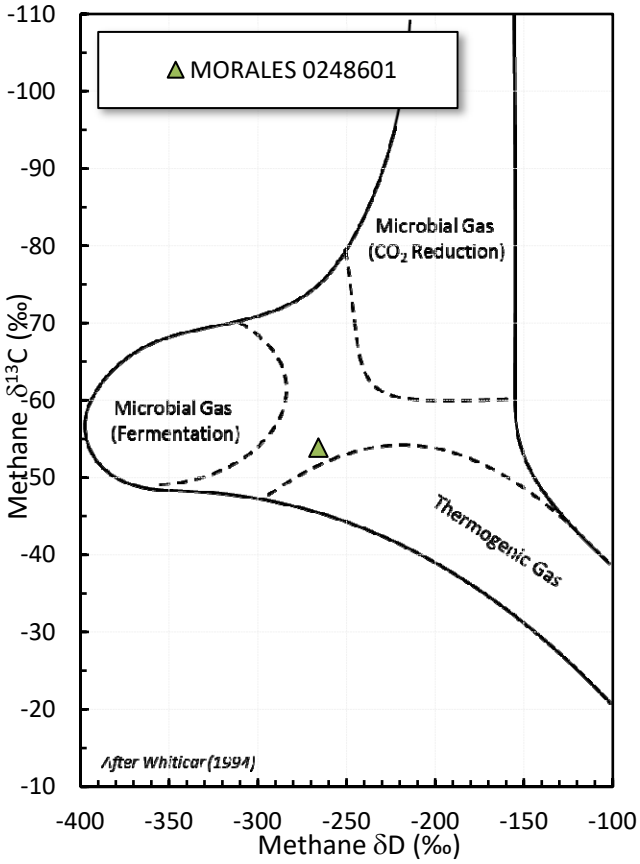
Error δD < 5.0 ‰

Stable Isotope Interpretive Plots

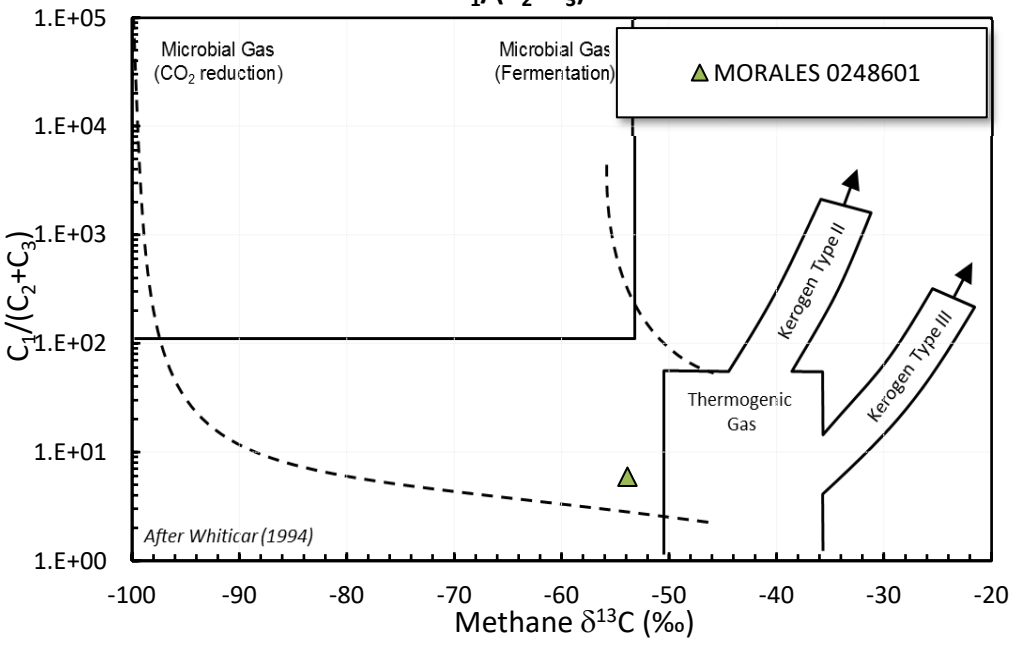
Methane vs Gas Wetness Genetic



Methane $\delta^{13}C$ vs δD Genetic Classification Plot



Methane $\delta^{13}C$ vs $C_1/(C_2+C_3)$ Genetic Classification Plot



Chain of Custody Form

dig
Dolan Integration Group

Geochemistry for Energy
1317 West 121st Ave
Westminster, CO 80234
p: 303.531.2030

Job 20033693
DIG - 022410

Send Data and Invoice to:

Name: Jennifer Pellegrini
Company: Origins Laboratory
Address: 1725 W. Elk Pl
Denver, CO 80211
Phone: 303-433-1322
Fax:
Email: jpellegrini@originslab.com

AFE #:
Report Ctr:
Project: Y003187
PO #:
Location:
Sampled By:

Sample Description

Container #	Sample Identification	Date Sampled	Time	Gas Composition* $N_2, O_2, CO_2, He, H_2, C_1$-$C_6$+	RSK-175* (gas composition) $N_2, O_2, CO_2, He, H_2, C_1$-$C_6$+ with dissolved C1, C2 & C3	$\delta^{13}C$ Methane (Carbon)	δD Methane (Hydrogen)	$\delta^{13}C$ Ethane-Pentane ($C_{2's}$, if present)	Comments
Y003187-01	morales 02486001	3/11/20	1000	X		X	X		

Chain-of-Custody Record

	Signature	Company	Date	Time
Relinquished by		Origins	3/20/20	1215
Received by		DIG	3/20/20	1215
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

Organization	Reporting Organization	Reporting Organization Name	Order Number	Entity Requesting Analysis	Purpose	Project															
	10206	Dolan Integration Group		Origins Laboratory																	
Sample	COGCC Facility No.	Sample Date and Time	API #	LAB Sample ID	Sample Type	Matrix	Comments	Project Number	Chain of Custody ID	Date Received by Lab											
		3/11/20 10:00 AM		DIG-022410		GAS			MORALES 0248601	3/20/2020											
Batch	LabID	Lab Batch Identifier	Leach Date	Extract Date and Time	Extract Method	Start Date and Time	Conc Method	Init Vol	Final Vol	Init Vol Units	Final Vol Units	Analysis Date and Time	Report Basis	Comments	File Name	Column #					
	10206	20033693																			
Result	CAS Number	Analysis Name	Analysis Method	Analytical Method Modifier	Unit	Result Value	Qualifier	Test Type	Result Text	Data Flag	Dilution	Fraction Type	MDC	Requested MDC	Detection Limit	Instrument Detection Limit	Method Detection Limit	Comments	AnalyticalBatchID		
	O2+AR	OXYGEN + ARGON	SOP		MOL %	2.63									0.005	0.005	0.005		20033693		
	124-38-9	CARBON DIOXIDE	SOP		MOL %	0.11									0.005	0.005	0.005		20033693		
	7727-37-9	NITROGEN (N2)	SOP		MOL %	17.90									0.005	0.005	0.005		20033693		
	7440-59-7	Helium	SOP		MOL %	0.01	ND								0.005	0.005	0.005		20033693		
	1333-74-0	HYDROGEN	SOP		MOL %	0.01	ND								0.005	0.005	0.005		20033693		
	74-82-8	METHANE	SOP		MOL %	66.62									0.005	0.005	0.005		20033693		
	74-84-0	ETHANE	SOP		MOL %	7.83									0.005	0.005	0.005		20033693		
	74-85-1	ETHENE	SOP		MOL %	0.01	ND								0.005	0.005	0.005		20033693		
	74-98-6	PROPANE	SOP		MOL %	3.43									0.005	0.005	0.005		20033693		
	75-28-5	ISOBUTANE	SOP		MOL %	0.42									0.005	0.005	0.005		20033693		
	106-97-8	N-BUTANE	SOP		MOL %	0.72									0.005	0.005	0.005		20033693		
	iC5	ISOPENTANE	SOP		MOL %	0.15									0.005	0.005	0.005		20033693		
	109-66-0	N-PENTANE	SOP		MOL %	0.12									0.005	0.005	0.005		20033693		
	92112-69-1+	C6+ (hexanes +)	SOP		MOL %	0.07									0.005	0.005	0.005		20033693		
	delta13C_C1	DELTA 13C C1	SOP		per mil	-53.9													20033693		
	deltaD_C1	DELTA D C1	SOP		per mil	-266													20033693		