



**dig**  
Dolan Integration Group

Geochemistry for Energy

11025 Dover Street Unit 800  
Westminster, CO 80021  
p: 303.531.2030

**Quantitative High Resolution Whole Oil Gas Chromatography  
Analytical Results**

**Job #: 260315606**

**Lab #: DIG-043485-043486**

**Client: Energy and Carbon Management Commission**

**Project/ Well Name: FAC 5 OIL @ SEP & FAC 7 COND @ VSEP**

**API:**

**Facility ID:**

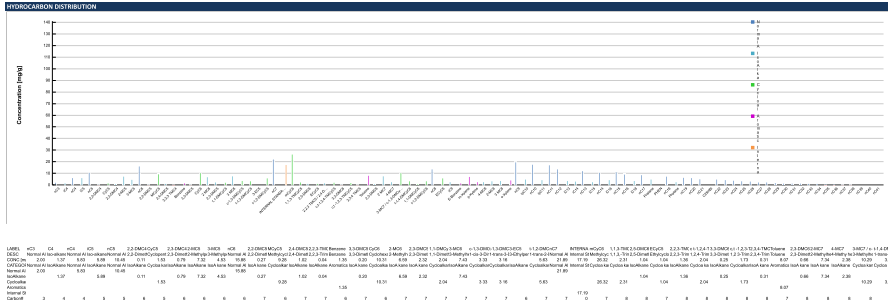
**Sample Types: Oil/Condensate**

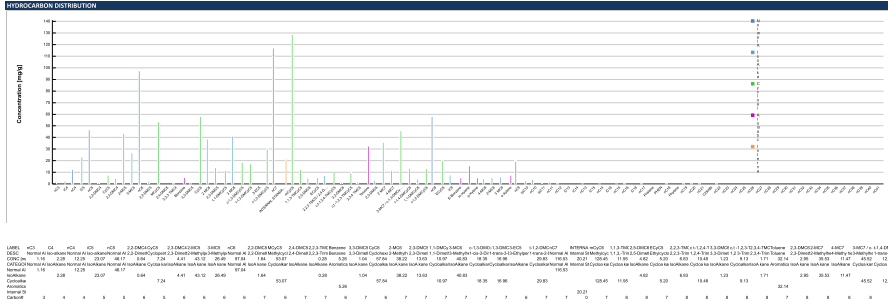
The analytical results, opinions, or interpretations contained in this report are based upon information and material supplied by the client for whose exclusive and confidential use this report has been made. The analytical results, opinions, or interpretations expressed represent the best judgment of Dolan Integration Group based on its experience, but any interpretation of test or other data, and any recommendation(s) based upon such interpretations, are opinions based upon inferences from measurements and empirical relationships and assumptions which are not infallible, and with respect to which professional engineers and analysts may differ. Accordingly, Dolan Integration Group makes no warranty or representation, expressed or implied, of any type, and expressly disclaims same as to the productivity, proper operations, or profitability of any oil, gas, coal, or other mineral, property, well, or sand in connection with which such report is used or relied upon for any reason whatsoever. This report shall not be reproduced, in whole or in part, without the written approval of Dolan Integration Group.

Dolan Integration Group shall use commercially reasonable efforts to maintain the Samples it receives from Customer in the condition in which same were initially received, and shall store, free of charge, any portion(s) of the Sample(s) not consumed or altered in the course of testing and analysis for a period of 60 days after their initial receipt, after which time the Samples will be destroyed. At Customer's written request and expense, Dolan Integration Group shall return unused Samples to Customer. At Customer's written request, Dolan Integration Group will also store and maintain Customer's Samples beyond the Free Storage Period for a monthly fee in accordance with Dolan Integration Group's the current storage rates. If Customer fails to timely pay any applicable storage charges, Dolan Integration Group shall be free to destroy the Sample.

© Dolan Integration Group, LLC







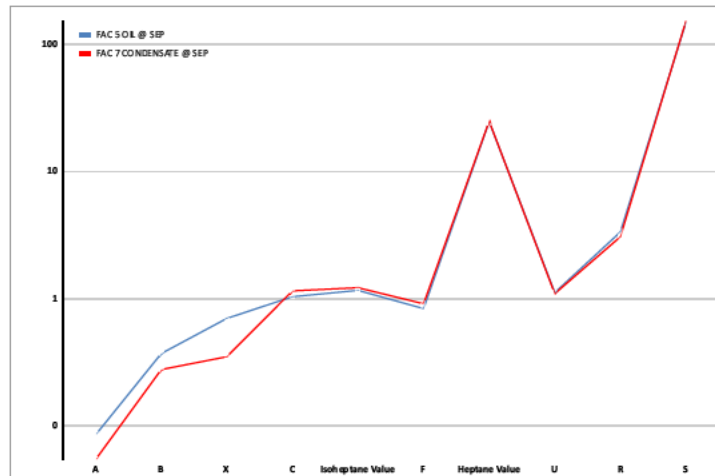
Definitions & Interpretations

Thompson ratios describe processes affecting light hydrocarbons (C<sub>6</sub>-C<sub>7</sub>)

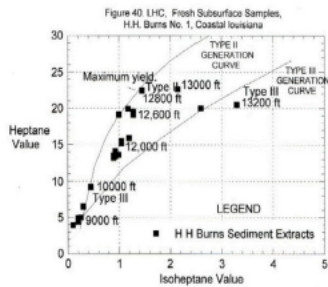
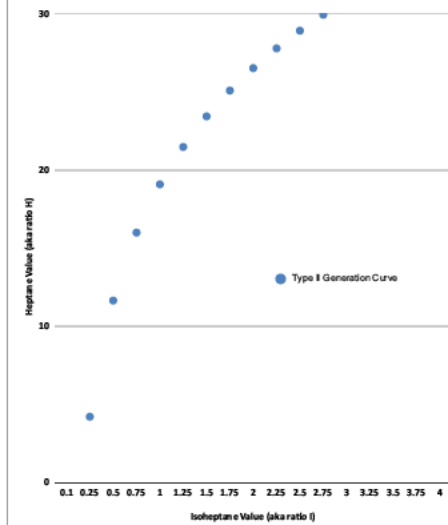
Name	Ratio	Property	Process
A	benzene / n-hexane	Aromaticity	Fractionation, water washing, TSR
B	toluene / n-heptane	Aromaticity	Fractionation, water washing, TSR
X	(m-xylene + p-xylene) / n-octane	Aromaticity	Fractionation, water washing, TSR
C	(n-hexane + n-heptane) / (cyclohexane + methylcyclohexane)	Paraffinicity	Maturity, biodegradation
I	(2- + 3-methylhexane) / (1c3- + 1t3- + 1t2-DMCP)	Paraffinicity	Maturity, source, biodegradation
F	n-heptane / methylcyclohexane	Paraffinicity	Maturity, biodegradation
H	(100*n-heptane) / (Σcyclohexane + ΣC <sub>7</sub> HCs)	Paraffinicity	Maturity, source, biodegradation
S	n-hexane / 2,2-dimethylbutane	Paraffin branching	Maturity, source, biodegradation
R	n-heptane / 2-methylhexane	Paraffin branching	Maturity, source, biodegradation
U	cyclohexane / methylcyclohexane	Naphthene branching	Maturity, source

DMCP, dimethylcyclopentane; H, heptane value; I, isoheptane value; Σcyclohexane, [cyclohexane + 1,1-DMCP + 1c3-DMCP + 1t3-DMCP + 1t2-DMCP + methylcyclohexane]; ΣC<sub>7</sub> HCs, [Σcyclohexane + 2-methylhexane + 3-methylhexane + n-heptane + 2,3-dimethylpentane + 3-ethylpentane]; 1c3, 1-cis-3; 1t3, 1-trans-3.

Thompson Ratios

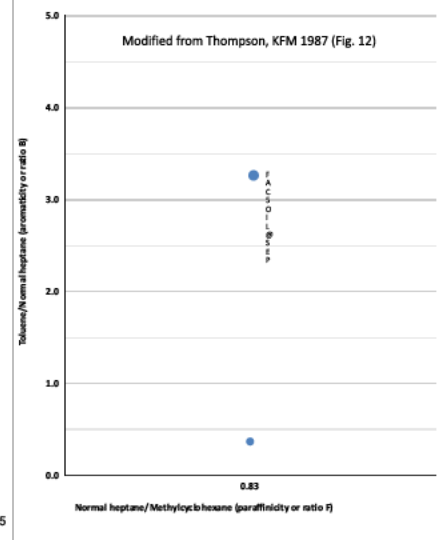


Heptane Plot - Light Hydrocarbon Maturity



Thompson K F M. Classification and thermal history of petroleum based on light hydrocarbons. *Geochimica et Cosmochimica Acta*, 1983, 47(2):303-316.

Oil Alteration Vectors

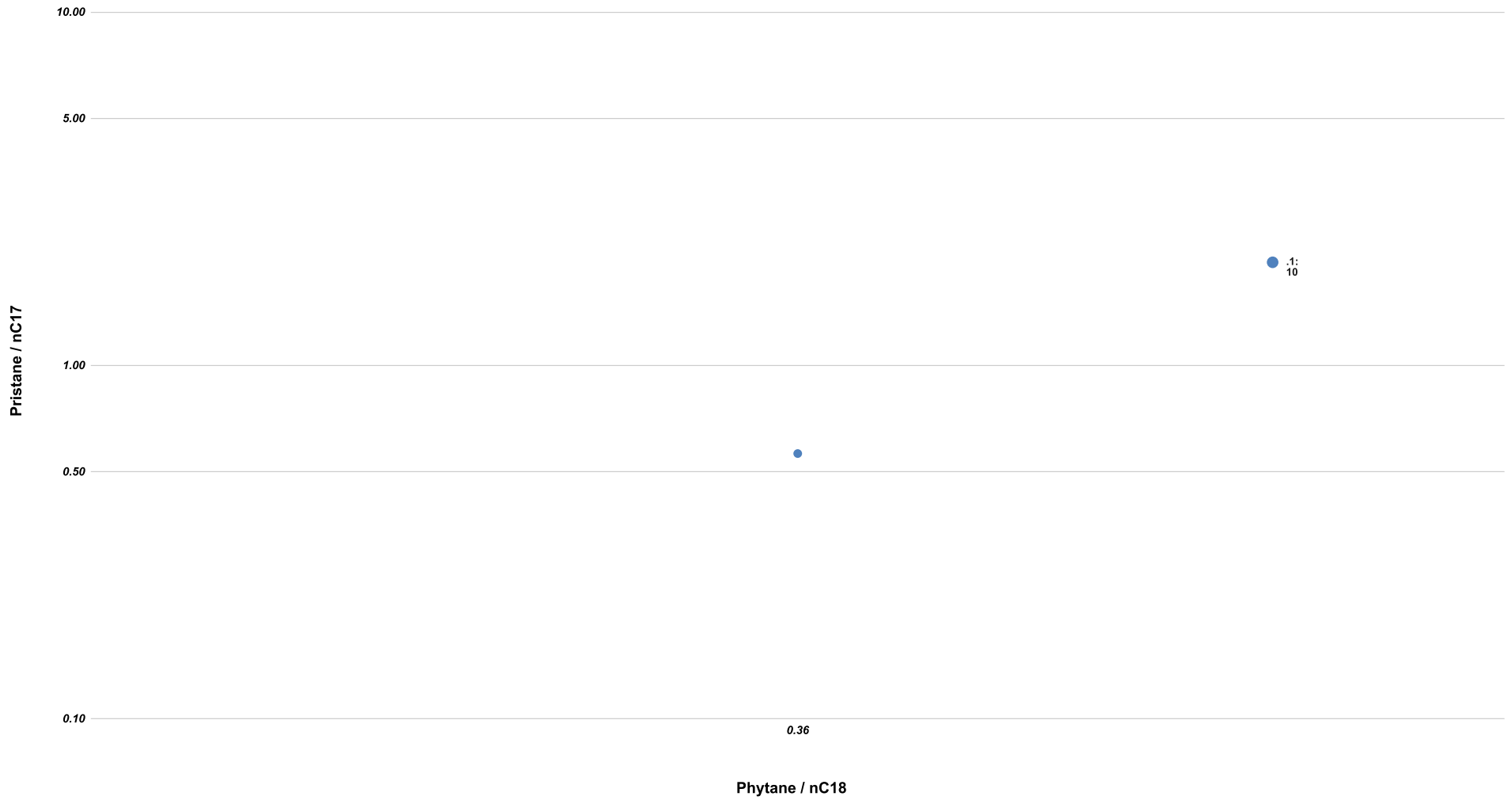


**Evaporative Fractionation**

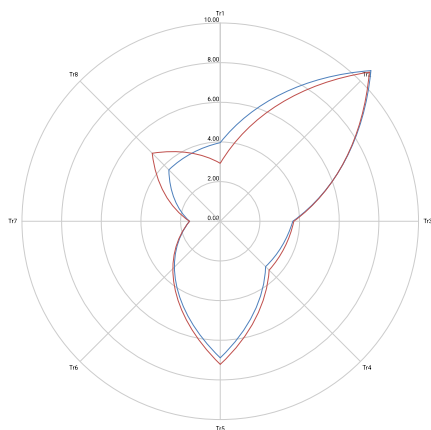
- Physical processes can also fractionate petroleum during migration.
- As petroleum migrates upward, temperature and pressure decrease. If the bubble point is reached, a single phase fractionates into liquid and gas phases that can migrate separately.
- Partitioning of petroleum between these phases depends on the vapor equilibrium constants for each component (Thompson, 1987). This can result in reservoirs filled with petroleum from a common source, but with different gross compositions.
- The effects of evaporative or phase fractionation were described based mostly on laboratory experiments (e.g. Thompson, 1987; Larter and Mills, 1991; van Graas et al., 2000).
- The process leads to oils deficient in light ends and enriched in aromatics, as exemplified by many U.S. Gulf Coast oils (Thompson, 1987, 1988).

Peters & Fowler, *Organic Geochemistry* 33 (2002) pp 5-36

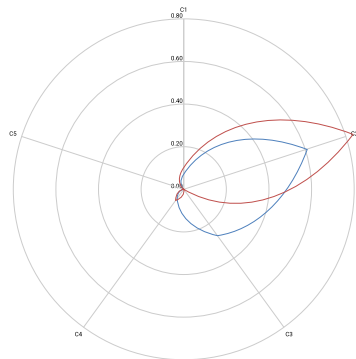
**CONNAN PLOT - SOURCE ROCK DEPOSITION/MATURATION CHARACTERIZATION**



Halpern Transformation Ratios



Halpern Correlation Ratios


 Table 7.3. Halpern (1995)  $C_7$  ratios for use in star diagrams to differentiate oils

Name	Ratio	$\Delta$ BP ( $^{\circ}$ C)	$\Delta$ Solubility (ppm)	Process
TR1	Toluene/X	22.8	496	Water washing
TR2	$n$ C <sub>7</sub> /X	10.6	-21.8	Biodegradation
TR3	3-Methylhexane/X	4.0	-21.4	
TR4	2-Methylhexane/X	2.2	-21.5	Evaporation
TR5	P2/X	(3.2)	(-21.4)	
TR6	1- <i>cis</i> -2-Dimethylcyclopentane/X	11.7	-11.0	Correlation
TR7	1- <i>trans</i> -3-Dimethylcyclopentane/X	3.0	-4.0	
TR8	P2/P3	(6)	(-2.4)	
C1	2,2-Dimethylpentane/P3	(-5.8)	(-0.6)	
C2	2,3-Dimethylpentane/P3	(4.8)	(0.3)	
C3	2,4-Dimethylpentane/P3	(-4.5)	(-0.6)	
C4	3,3-Dimethylpentane/P3	(1.1)	(0.9)	
C5	3-Ethylpentane/P3	(8.5)	(-2.0)	

X = 1,1-dimethylcyclopentane, boiling point 87.8 $^{\circ}$ C, solubility 24 ppm. P2 = 2-methylhexane + 3-methylhexane, boiling point 91 $^{\circ}$ C, solubility 2.6 ppm. P3 = 2,2-dimethylpentane + 2,3-dimethylpentane + 2,4-dimethylpentane + 3,3-dimethylpentane + 3-ethylpentane, boiling point 85 $^{\circ}$ C, solubility 5 ppm.

$\Delta$ BP = boiling point numerator - boiling point denominator ( $^{\circ}$ C).

$\Delta$ Solubility = solubility of numerator - solubility of denominator (ppm in distilled water).

Parentheses indicate average values for mixtures.







main 303.531.2030 • info@digforenergy.com • digforenergy.com  
Office and Lab 11025 Dover St • Ste 800 • Westminster, CO 80021

Encrypted Report PDF

Send Data to:	Send Invoice to (if different):	Additional Information:
Name: Laurel Anderson, Nikki Graber	Name:	AFE #:
Company: ECMC	Company:	Project:
Address: 1120 Lincoln Street, Suite 801	Address:	PO #: GAE PHAA 2025*02668
City, State: Denver, CO 80203	City, State:	Location: Facility 5
Phone: 970-404-9911	Phone:	Sampled By: Laurel Anderson
Email: laurel.anderson@state.co.us, nikki.graber@state.co.us	Email:	API #:

Turnaround Time\*\*:

Standard (≤ 10 Business days)
  Rush (≤ 5 Business days)
  Expedited Rush (≤ 3 Business days)

Container Number	Sample Identification	Date Sampled	Time	Sample Type*	Gas Composition	d13C of Methane (C1)	d13C of Ethane (C2)	d13C of Propane+ (C3+)	d13C of Carbon Dioxide (CO2)	dD of Methane (C1)	Whole Oil Gas Chromatography (with ASTM D1250)	ASTM D1250 (API Gravity)	Isotopes of Water	d18O and dD	RSK 175 Dissolved Gas Quantification	d13C of Dissolved Inorganic Carbon (DIC)	Other (specify):
2	FAC 5 OIL @ 5EP	4/13/26	10:19	OIL							<input checked="" type="checkbox"/>						
2	FAC 7 COND @ 4SEP	4/13/26	10:43	CONDENSATE							<input checked="" type="checkbox"/>						

Chain of Custody Record

Comments: Whole Oil Analysis with Pristane/Phytane ratios

Relinquished by Signature	Company	Date	Time	Received by Signature	Company	Date	Time
	ECMC	4/13/26	10:52		ECMC	4/14/26	10:55
	ECMC				DIG	4/13/26	1136

\*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.

\*\* Rush and Expedited Rush turnaround time analysis will incur additional costs at 2x and 3x the standard turnaround time pricing.