CMS-300 CONVENTIONAL PLUG ANALYSIS
RACE DATA (Fast-Track)
DJ Simmons
Pinto 1-7
Paradox Basin
Dolores County, Colorado

CL File Number: HOU-131377

Date: 12/19/13

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Sample Number	Depth (ft)	Net Confining Stress (psig)	Porosity (%)	Permeability		b(air) psi	Beta ft(-1)	Alpha (microns)	Saturation	Grain Density (g/cm3)	Footnote
				Klinkenberg (md)	Kair (md)				Water % Pore Volume		
1H	6265.50	1200	4.92	.008	.024	66.14	1.70E+14	4.19E+03	32.3	2.867	(6)
2H	6266.30	1200	4.24	.003	.013	88.93	7.84E+14	8.64E+03	13.1	2.885	(6)
3H	6267.25	1200	5.41	.079	.175	31.00	1.34E+13	3.42E+03	27.6	2.873	(6)
4H	6268.00	1200	7.67	4.53	5.34	3.56	9.41E+10	1.38E+03	20.5	2.861	(6)
5H	6268.50	1200	7.23	2.22	2.48	2.45	1.55E+11	1.12E+03	28.5	2.852	(6)
6H	6269.30	1200	8.02	9.91	11.7	3.54	1.42E+10	4.54E+02	32.2	2.847	(6)
7H	6270.20	1200	8.72	11.0	12.8	3.05	1.26E+10	4.49E+02	23.5	2.853	(6)
8H	6271.20	1200	12.18	54.8	66.2	3.61	9.87E+08	1.75E+02	30.3	2.848	(6)
9H	6272.20	1200	10.64	6.84	8.15	3.73	5.80E+10	1.28E+03	37.5	2.847	(6)
10H	6273.25	1200	12.25	12.2	14.2	3.07	7.03E+09	2.77E+02	38.7	2.850	(6)
11H	6274.15	1200	9.46	9.07	11.3	4.80	2.83E+10	8.29E+02	35.6	2.840	(6)

Footnotes :

(6) : Fast-Track analysis performed. Small quantities of oil and water may still be present in pore system.

Permeability greater than 0.1 mD measured using helium gas. Permeability less than 0.1 mD measured using nitrogen gas. All b values converted to b (air)

APPENDIX A: EXPLANATION OF CMS-300 TERMS "b", "Beta, and "Alpha"

K_∞	=	Equivalent non-reactive liquid permeability, corrected for gas slippage, mD
K_{air}	=	Permeability to Air, calculated using K_∞ and b, mD
b	=	Klinkenberg slip factor, psi
β (Beta)	=	Forcheimer inertial resistance factor, ft^{-1}
α (Alpha)	=	A factor equal to the product of Beta and K_∞. This factor is employed in determining the pore level heterogeneity index, H_i.
H_i	=	$\log_{10}(\alpha\phi/RQI)$ α, microns = $3.238E^{-9}\ \beta K_\infty$
Ø	=	Porosity, fraction
RQI	=	Reservoir Quality Index, microns
RQI	=	$0.0314(K/\phi)^{0.5}$

For further information please refer to:

Jones, S.C.: "Two-Point Determination of Permeability and PV vs. Net Confining Stress" SPE Formation Evaluation (March 1988) 235-241.

Jones S.C.: "A Rapid Accurate Unsteady-State Klinkenberg Permeameter," Soc. Pet. Eng. J. (Oct. 1972) 383-397.

Jones, S.C.: "Using the Inertial Coefficient, β, To Characterize Heterogeneity in Reservoir Rock: SPE 16949 (September 1987).

Amaefule, J.O.; Kersey, D.G.; Marschall, D.M.; Powell, J.D.; Valencia, L.E.; Keelan, D.K.: "Reservoir Description: A Practical Synergistic Engineering and Geological Approach Based on Analysis of Core Data,: SPE Technical Conference (Oct. 1988) SPE 18167.

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Sample Preparation
1.0" diameter plugs were drilled with nitrogen gas and trimmed into right cylinders with a diamond-blade trim saw.

Core Extraction
Samples selected for Fast-Track analysis were placed in Dean Stark equipment using toluene as the refluxing solvent.
Plugs were extracted for 72 hours to remove pore water.

Sample Drying
Samples were oven dried at 240° F for 24 hours.

Porosity
Porosity was determined using Boyle's Law technique by measuring grain volume at ambient conditions & pore volume at indicated net confining stresses (NCS)

Grain Density
Grain density values were calculated by direct measurement of grain volume and weight on dried plug samples.
Grain volume was measured by Boyle's Law technique.

Permeability
Permeability to air was measured on each sample using steady-state method at indicated NCS.

Fluid Saturations
Fluid saturations were determined by the Dean Stark technique using the following fluid properties:

Brine	1.032 g/cc (50000 ppm TDS)