Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Lower Kyalla Shale**
Sample Number:	44569-2M
Sample Type:	shale
Drill Depth, feet:	5,217.67-5,217.80
Temperature, °F:	180.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
302.37	2.92	2.81
761.98	5.25	5.36
1,221.30	6.79	6.91
1,677.66	7.93	7.94
2,135.86	8.83	8.69
2,593.23	9.23	9.25

| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0754
Intercept:	84.6576
Regression Coefficient (squared):	0.9977
Intercept Variation, psia*ton/scf:	10.4695
Slope Variation, ton/scf:	0.0064
G_{sL} Variation, scf/ton:	0.1384
P_L Variation, psia:	132.2809
Langmuir Volume, scf/ton:	13.26
Langmuir Pressure, psia:	1,122.62
Langmuir Equation:	$G_s = (G_{sL}*p)/(P_L+p)$
Pressure (Midpoint), psia:	2,150.00
Storage Capacity, scf/ton:	8.71

G_s Gas Storage Capacity

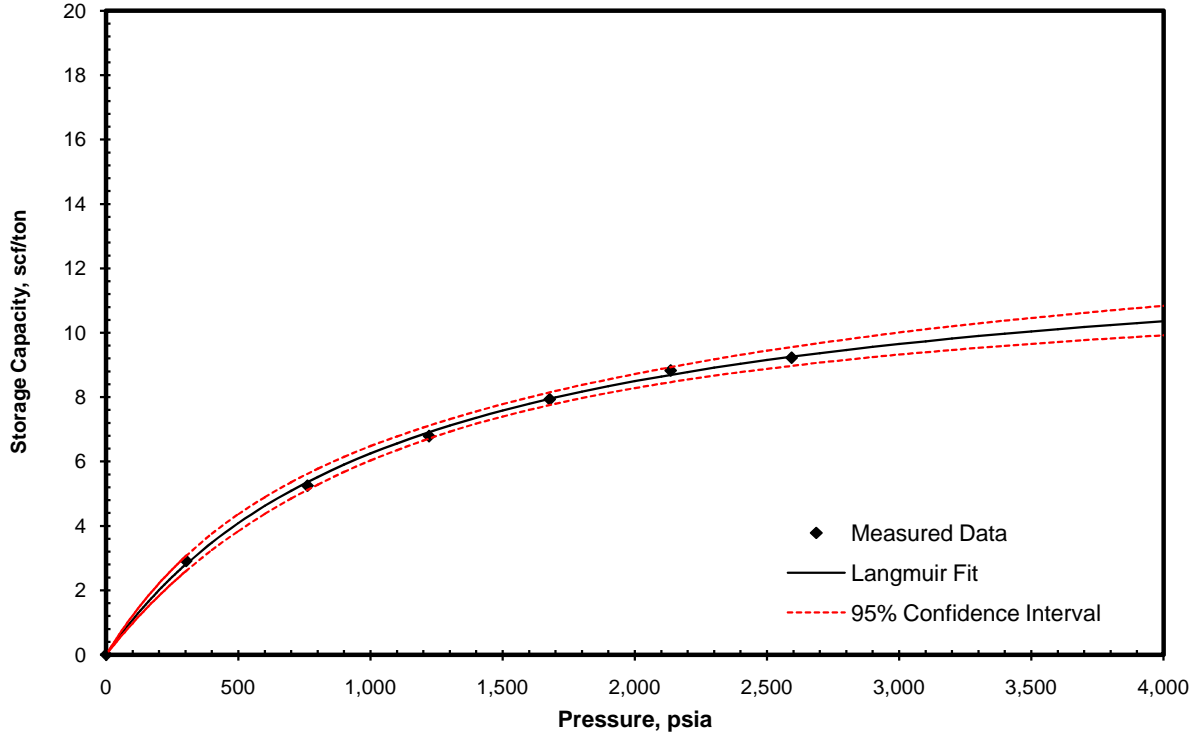G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 0.075x + 84.65
R² = 0.997
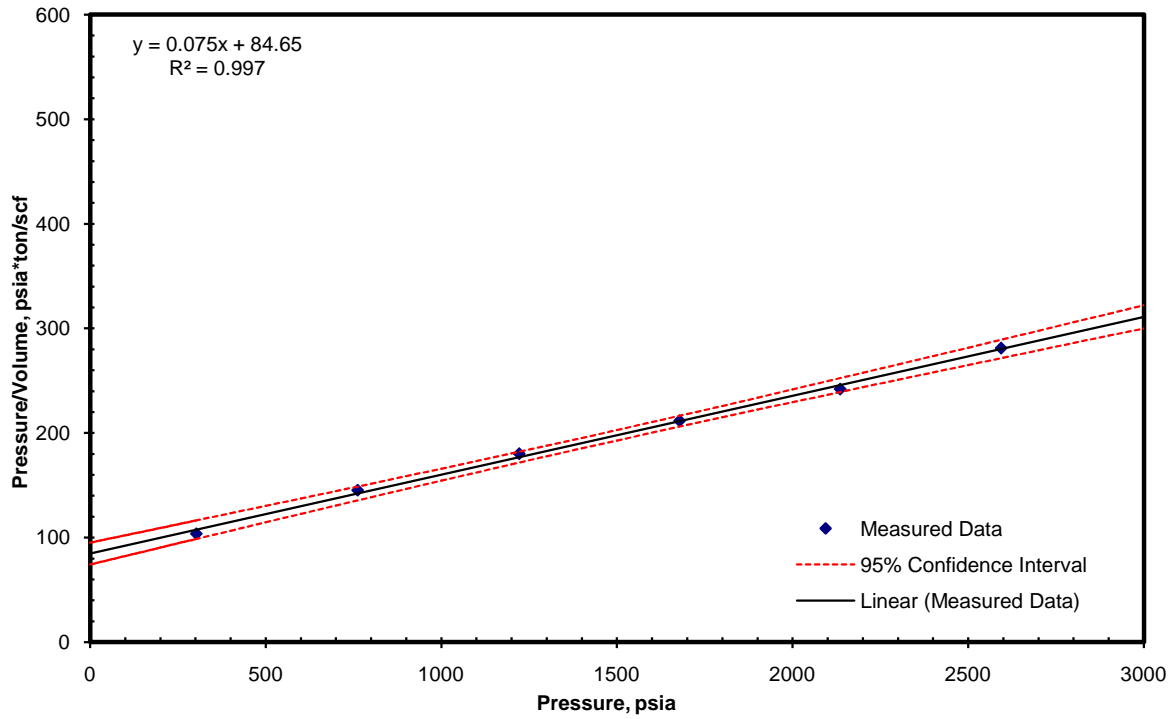
As-Received Langmuir Isotherm Graph

Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Lower Kyalla Shale**
Sample Number:	44569-2M
Sample Type:	shale
Drill Depth, meters:	1,590.27 - 1,590.30
Temperature,°C:	82.22

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
2.08	0.09	0.09
5.25	0.16	0.17
8.42	0.21	0.22
11.57	0.25	0.25
14.73	0.28	0.27
17.88	0.29	0.29

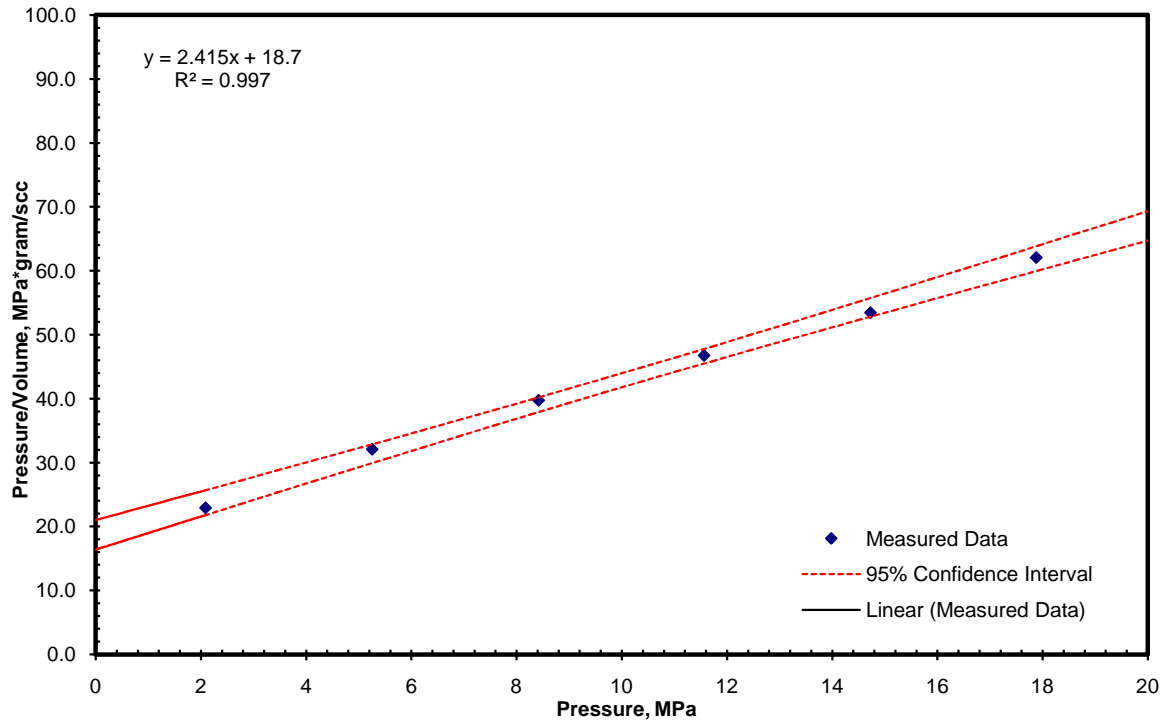| Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	2.4159
Intercept:	18.6997
Regression Coefficient (squared):	0.9977
Intercept Variation, Mpa*gram/scc:	2.3126
Slope Variation, gram/scc:	0.2037
G_{sL} Variation, scc/gram:	0.0303
P_L Variation, MPa:	1.5283
Langmuir Volume, scc/gram:	0.41
Langmuir Pressure, MPa:	7.74
Langmuir Equation:	$V=0.4*P/(P+7.7)$
Pressure (Midpoint), MPa:	14.82
Storage Capacity, scc/gram:	0.27

G_s *Gas Storage Capacity*

G_{sL} *Langmuir Gas Storage Capacity*

P_L *Langmuir Pressure*

p   Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

As-Received Langmuir Isotherm Graph
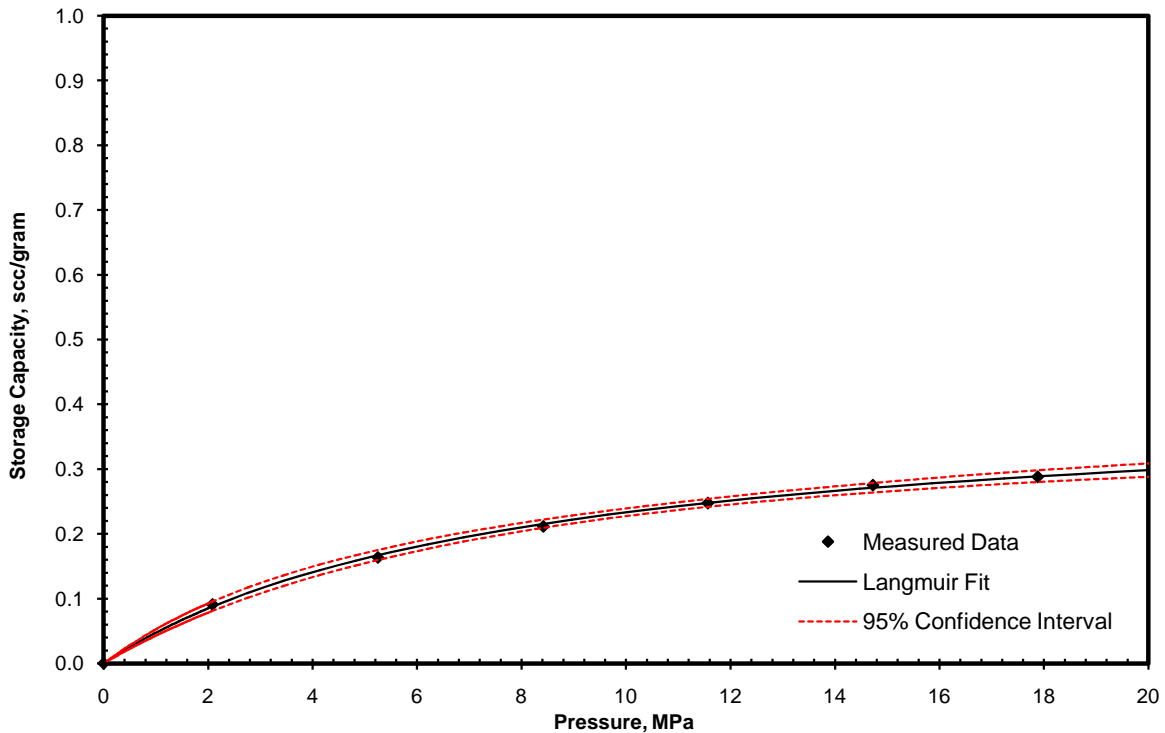
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Methane Adsorption Isotherm Summary

Well: **Shenandoah No. 1 Australia**
Reservoir: **Lower Kyalla Shale**
Sample Number: 44569-3M
Sample Type: shale
Drill Depth, feet: 5,226.63-5,226.70
Temperature, $^\circ$F: 180.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
302.35	2.10	2.09
761.27	4.71	4.72
1,218.39	6.86	6.86
1,679.99	8.64	8.66
2,130.71	10.10	10.14
2,598.91	11.51	11.45

Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0358
Intercept:	133.9191
Regression Coefficient (squared):	0.9994
Intercept Variation, psia*ton/scf:	2.4594
Slope Variation, ton/scf:	0.0015
G_{sL} Variation, scf/ton:	0.1442
P_L Variation, psia:	78.9943
Langmuir Volume, scf/ton:	27.95
Langmuir Pressure, psia:	3,742.61
Langmuir Equation:	$G_s = (G_{sL}*p)/(P_L+p)$
Pressure (Midpoint), psia:	2,150.00
Storage Capacity, scf/ton:	10.20

G_s Gas Storage Capacity

G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 0.035x + 133.9
R² = 0.999

- Measured Data
- 95% Confidence Interval
- Linear (Measured Data)

As-Received Langmuir Isotherm Graph

- Measured Data
- Langmuir Fit
- 95% Confidence Interval

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Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Lower Kyalla Shale**
Sample Number:	44569-3M
Sample Type:	shale
Drill Depth, meters:	1,593.00 - 1,593.03
Temperature,°C:	82.22

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
2.08	0.07	0.07
5.25	0.15	0.15
8.40	0.21	0.21
11.58	0.27	0.27
14.69	0.32	0.32
17.92	0.36	0.36

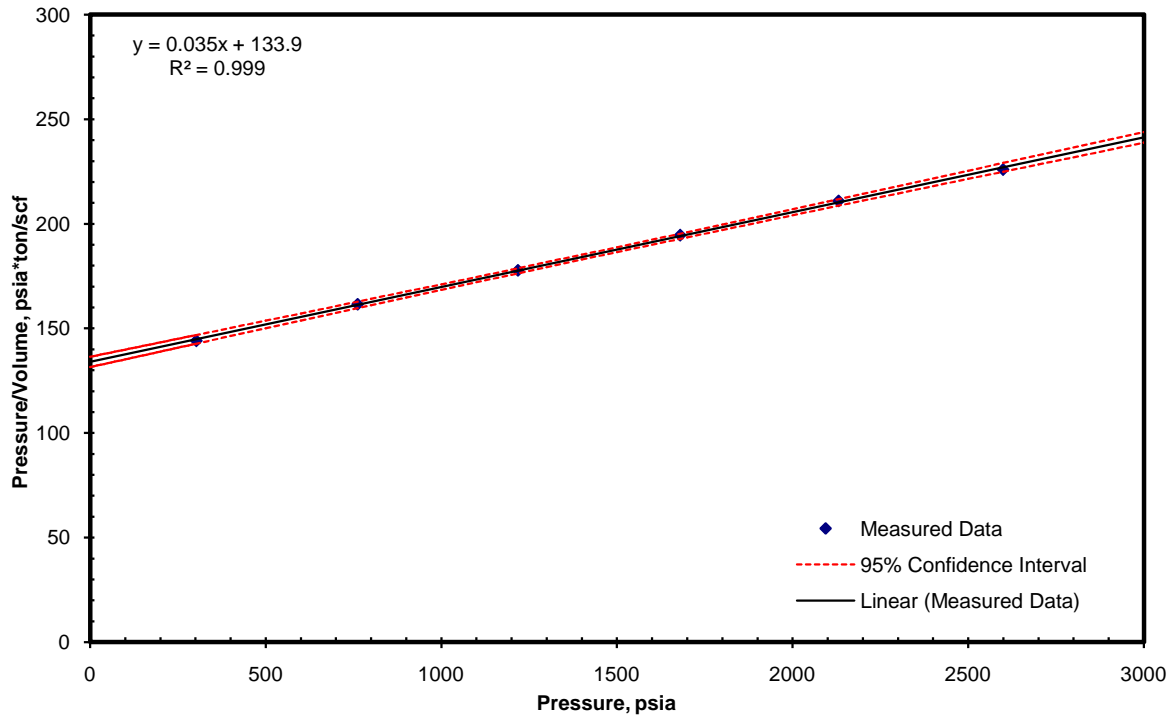| Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	1.1464
Intercept:	29.5809
Regression Coefficient (squared):	0.9994
Intercept Variation, Mpa*gram/scc:	0.5432
Slope Variation, gram/scc:	0.0478
G_{sL} Variation, scc/gram:	0.0315
P_L Variation, MPa:	1.4048
Langmuir Volume, scc/gram:	0.87
Langmuir Pressure, MPa:	25.80
Langmuir Equation:	V=0.9*P/(P+25.8)
Pressure (Midpoint), MPa:	14.82
Storage Capacity, scc/gram:	0.32

G_s *Gas Storage Capacity*

G_{sL} *Langmuir Gas Storage Capacity*

P_L *Langmuir Pressure*

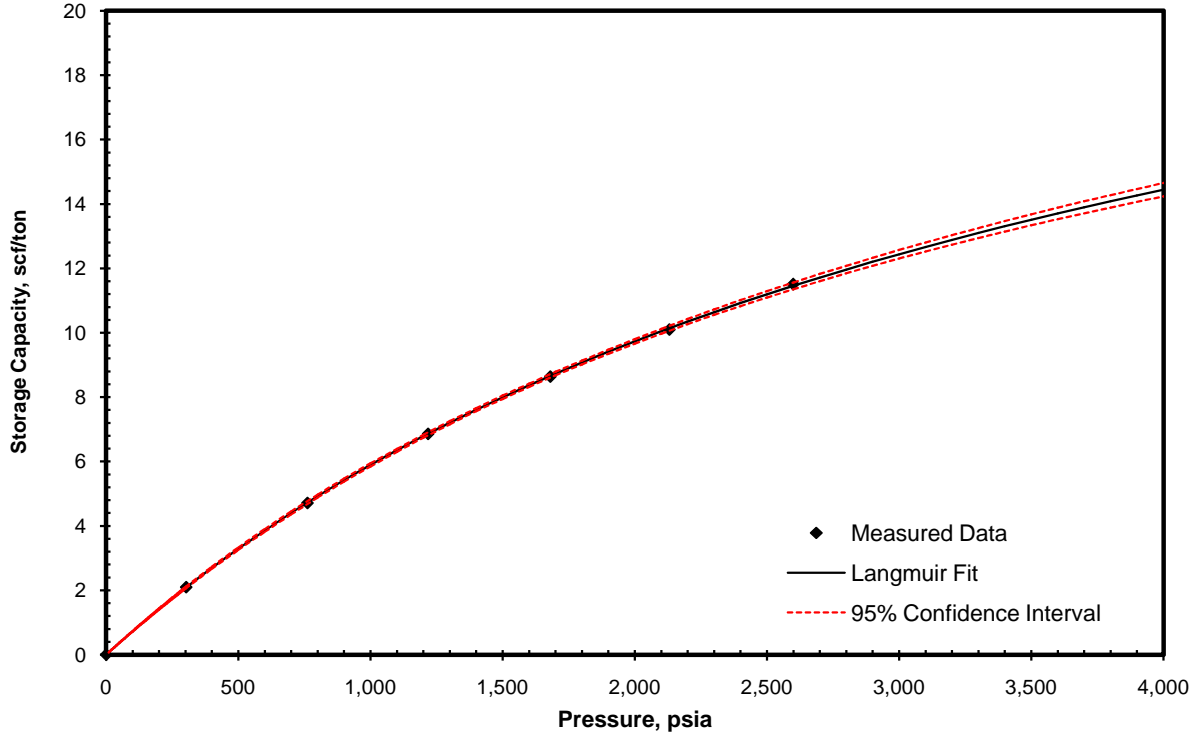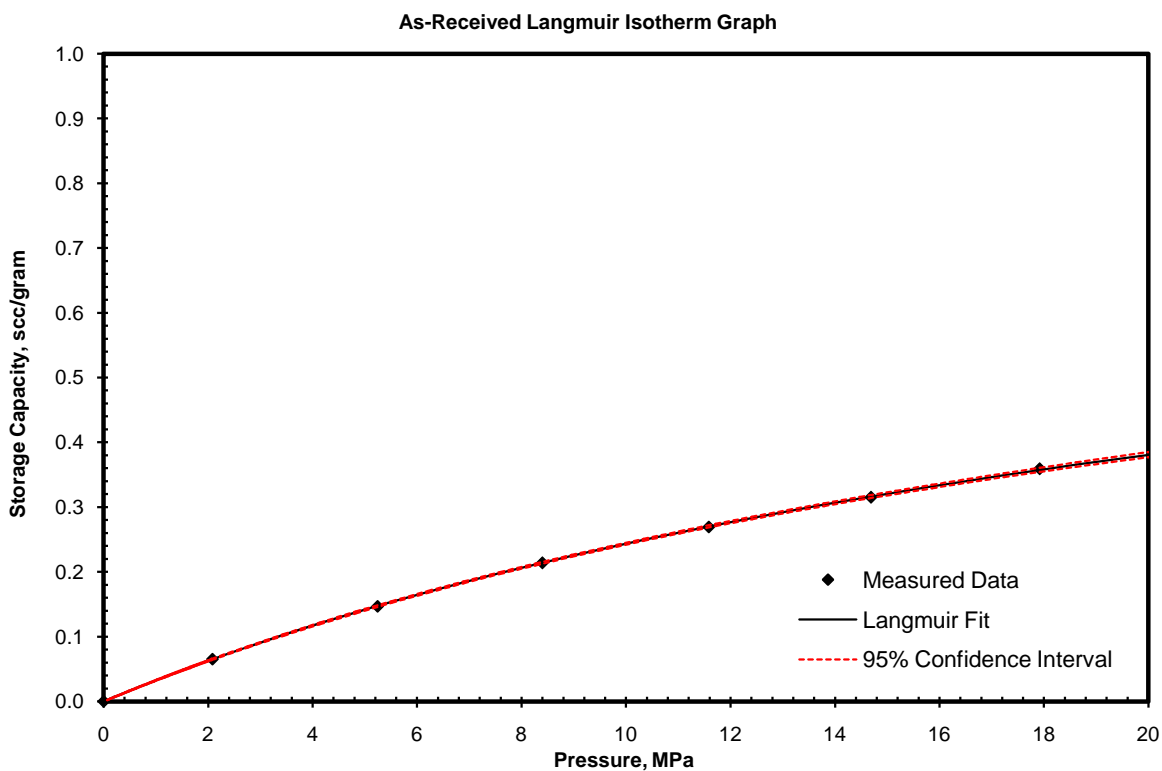p *Relevant Pressure (Reservoir Pressure)*

Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 1.146x + 29.58
R² = 0.999

- ◆ Measured Data
- ----- 95% Confidence Interval
- —— Linear (Measured Data)

*(Y-axis: Pressure/Volume, MPa*gram/scc; X-axis: Pressure, MPa)*

As-Received Langmuir Isotherm Graph

- ◆ Measured Data
- —— Langmuir Fit
- ----- 95% Confidence Interval

(Y-axis: Storage Capacity, scc/gram; X-axis: Pressure, MPa)

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Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Velkerri B Shale**
Sample Number:	44569-4M
Sample Type:	shale
Drill Depth, feet:	8,240.90-8,241.00
Temperature, °F:	220.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
488.18	15.77	15.36
924.61	24.13	24.22
1352.38	29.97	30.43
1791.23	34.28	35.21
2221.26	38.89	38.85
2659.52	42.40	41.82
3087.73	44.94	44.19
3527.31	46.44	46.22
3961.15	47.33	47.92

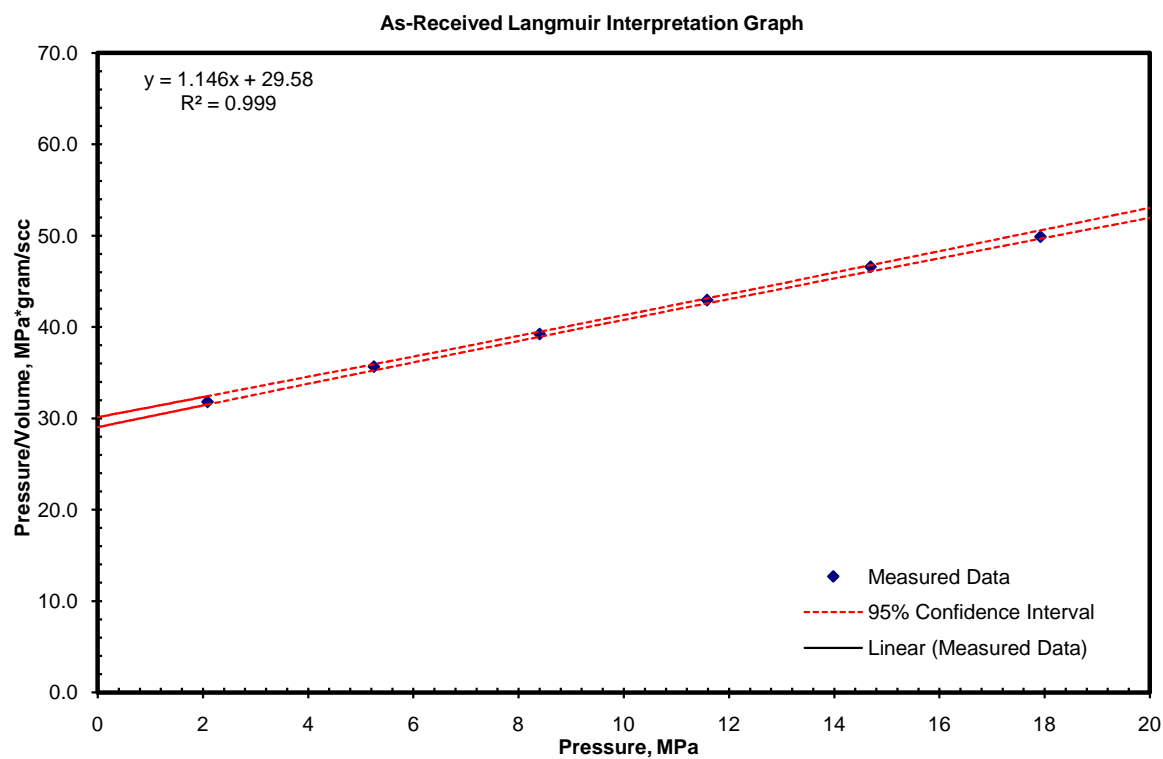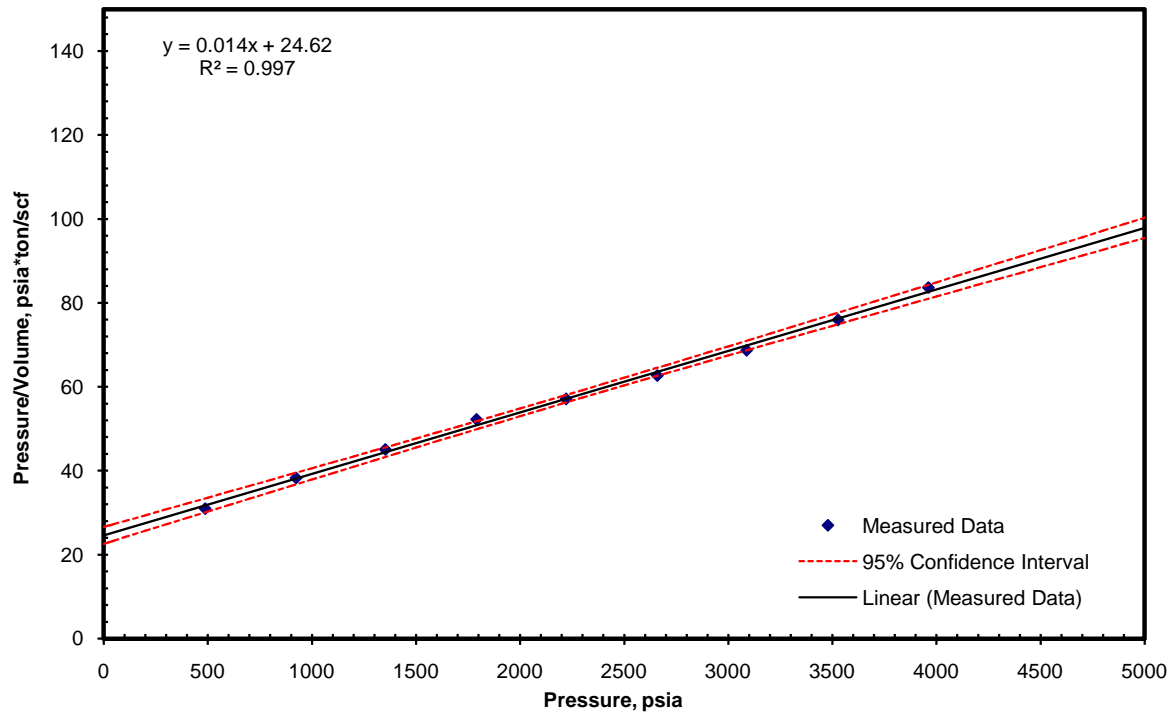| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0147
Intercept:	24.6264
Regression Coefficient (squared):	0.9974
Intercept Variation, psia*ton/scf:	2.0037
Slope Variation, ton/scf:	0.0008
G_{sL} Variation, scf/ton:	2.3781
P_L Variation, psia:	51.8352
Langmuir Volume, scf/ton:	68.25
Langmuir Pressure, psia:	1,680.78
Langmuir Equation:	V=68.3*P/(P+1,680.8)
Pressure (Midpoint), psia:	3,360.00
Storage Capacity, scf/ton:	45.49

G_s Gas Storage Capacity

G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

$y = 0.014x + 24.62$
$R^2 = 0.997$

- ◆ Measured Data
- - - - - 95% Confidence Interval
- —— Linear (Measured Data)

X-axis: Pressure, psia
Y-axis: Pressure/Volume, psia*ton/scf

As-Received Langmuir Isotherm Graph

- ◆ Measured Data
- —— Langmuir Fit
- - - - - 95% Confidence Interval

X-axis: Pressure, psia
Y-axis: Storage Capacity, scf/ton

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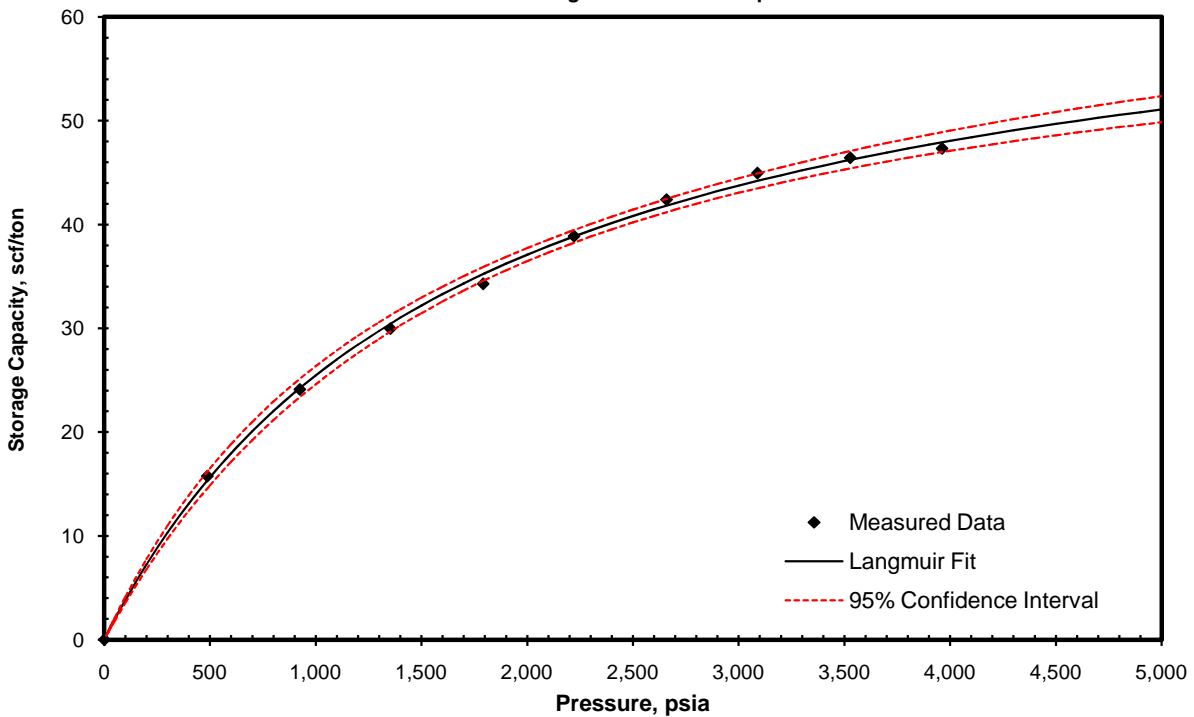
Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Velkerri B Shale**
Sample Number:	44569-4M
Sample Type:	shale
Drill Depth, meters:	2,511.70-2,511.73
Temperature, $^{\circ}$C:	104.44

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
3.37	0.49	0.48
6.37	0.75	0.76
9.32	0.94	0.95
12.35	1.07	1.10
15.32	1.21	1.21
18.34	1.32	1.31
21.29	1.40	1.38
24.32	1.45	1.44
27.31	1.48	1.50

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	0.4694
Intercept:	5.4396
Regression Coefficient (squared):	0.9974
Intercept Variation, Mpa*gram/scc:	0.4426
Slope Variation, gram/scc:	0.0258
G_{sL} Variation, scc/gram:	0.0763
P_L Variation, MPa:	0.4052
Langmuir Volume, scc/gram:	2.13
Langmuir Pressure, MPa:	11.59
Langmuir Equation:	V=2.1*P/(P+11.6)
Pressure (Midpoint), MPa:	23.17
Storage Capacity, scc/gram:	1.42

G_s *Gas Storage Capacity*

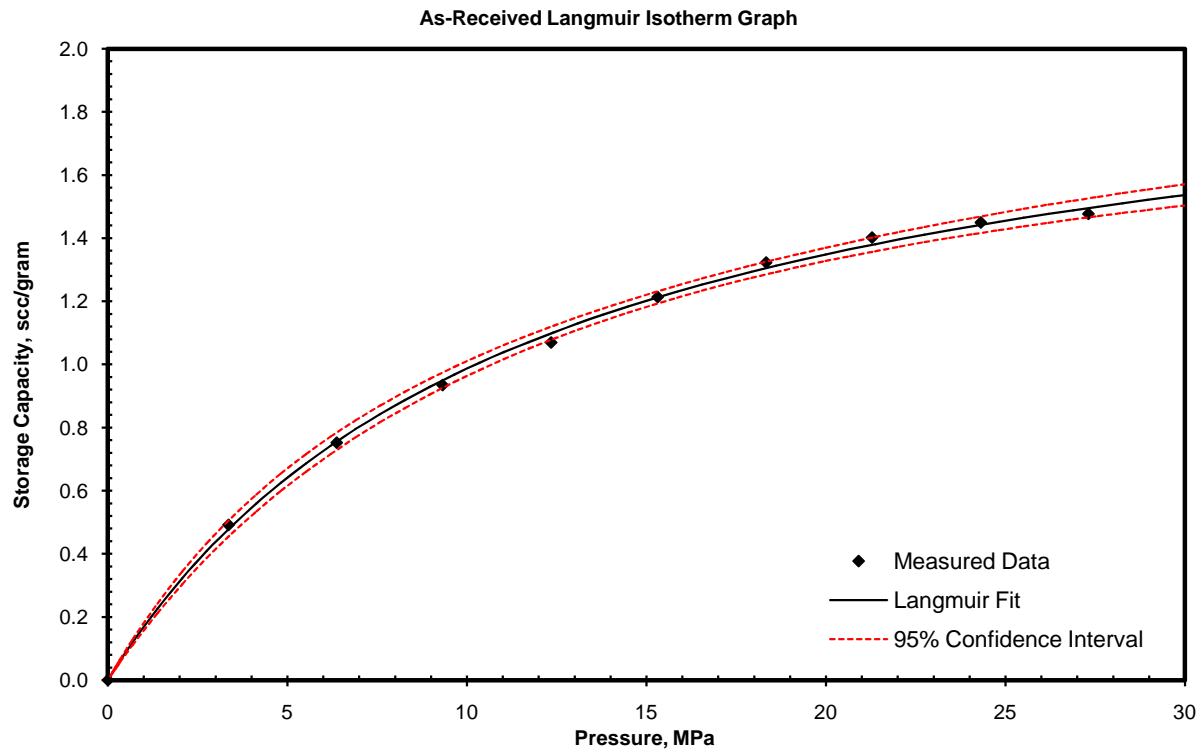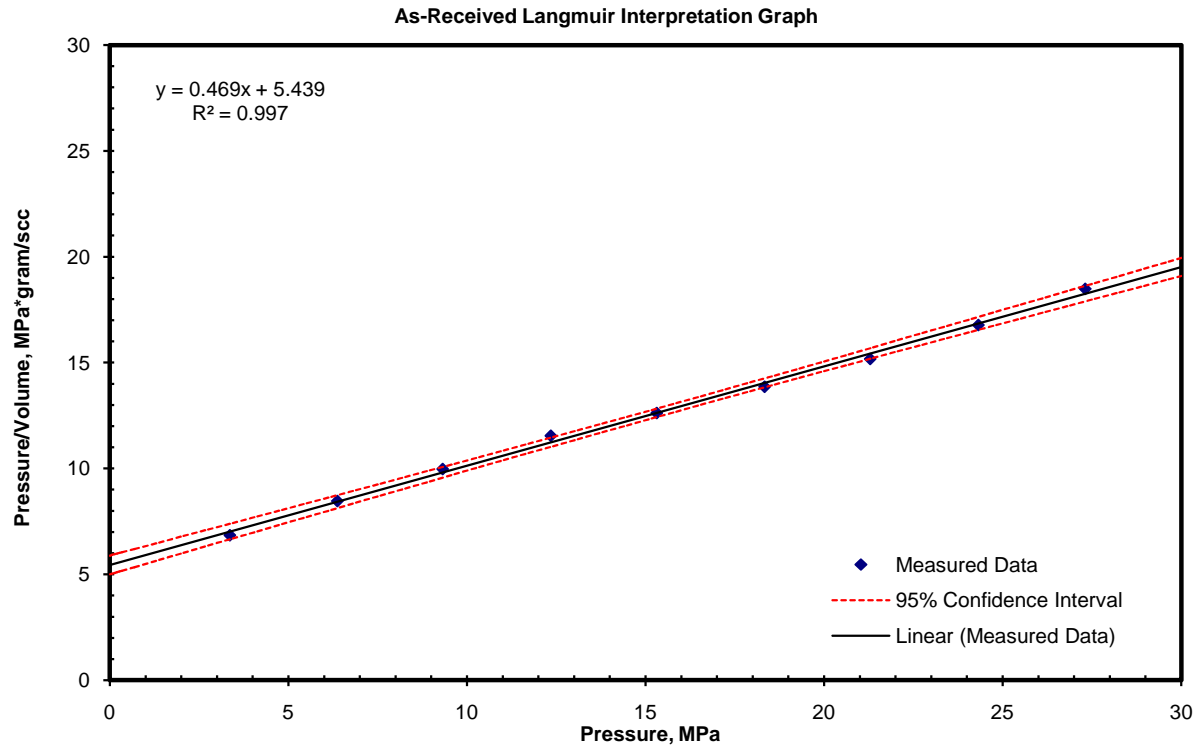G_{sL} *Langmuir Gas Storage Capacity*

P_L *Langmuir Pressure*

p   *Relevant Pressure (Reservoir Pressure)*

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

$y = 0.469x + 5.439$
$R^2 = 0.997$

Legend:
- Measured Data
- 95% Confidence Interval
- Linear (Measured Data)

Y-axis: Pressure/Volume, MPa*gram/scc
X-axis: Pressure, MPa

As-Received Langmuir Isotherm Graph

Legend:
- Measured Data
- Langmuir Fit
- 95% Confidence Interval

Y-axis: Storage Capacity, scc/gram
X-axis: Pressure, MPa

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Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Velkerri B Shale**
Sample Number:	44569-5M
Sample Type:	shale
Drill Depth, feet:	8,247.45-8,247.50
Temperature, °F:	220.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
487.50	23.36	21.50
924.65	35.91	35.59
1359.57	45.86	46.45
1800.77	54.04	55.22
2240.52	59.60	62.35
2680.02	65.72	68.27
3117.89	73.56	73.24
3562.75	78.53	77.56
3998.18	83.72	81.22

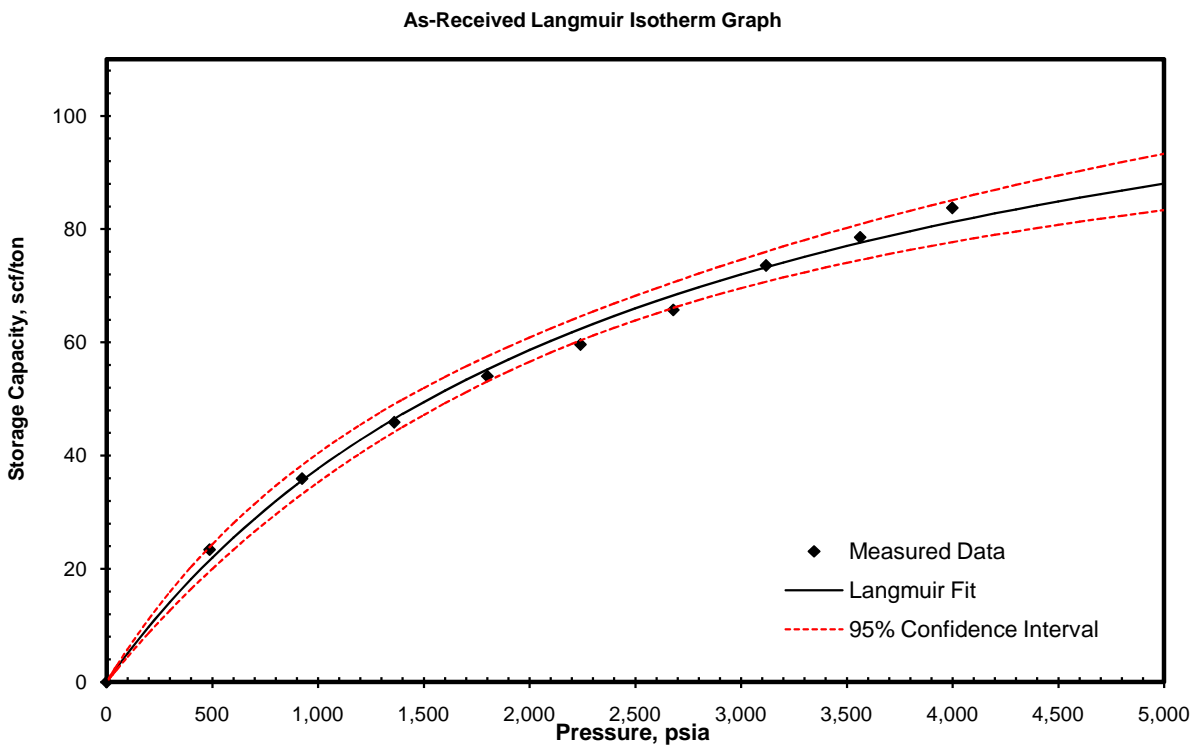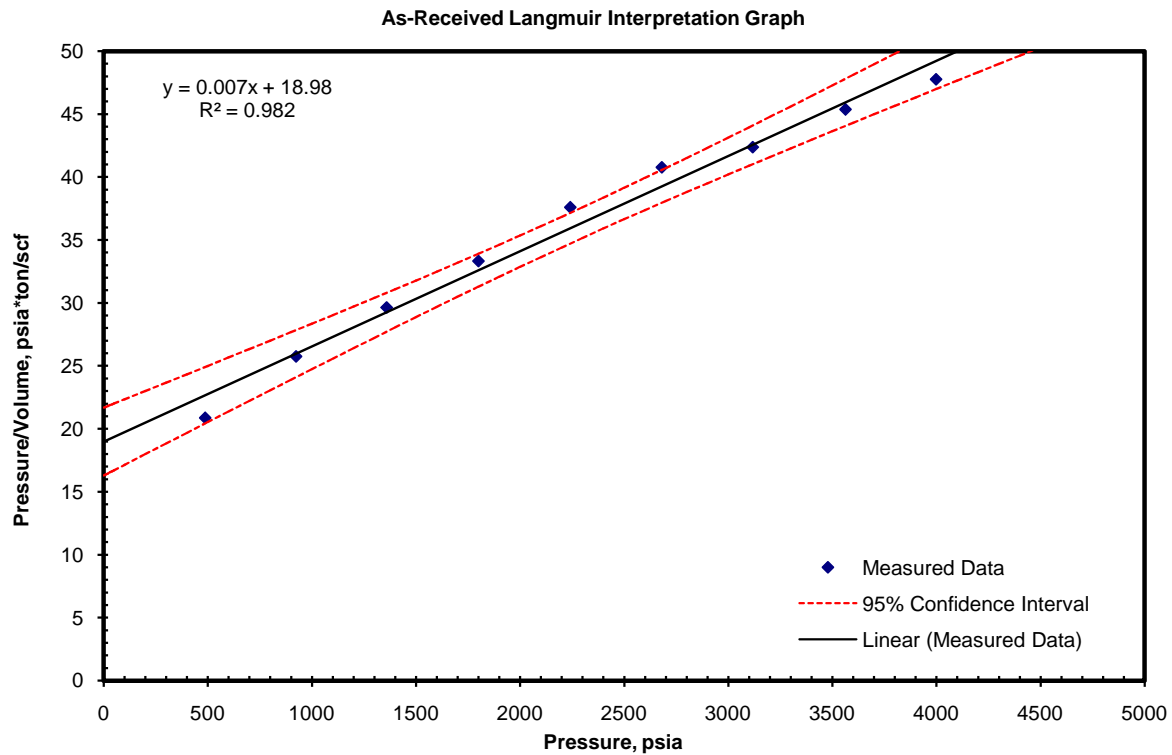| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0076
Intercept:	18.9878
Regression Coefficient (squared):	0.9828
Intercept Variation, psia*ton/scf:	2.6974
Slope Variation, ton/scf:	0.0011
G_{sL} Variation, scf/ton:	11.8797
P_L Variation, psia:	204.7536
Langmuir Volume, scf/ton:	132.21
Langmuir Pressure, psia:	2,510.37
Langmuir Equation:	$V=132.2*P/(P+2,510.4)$
Pressure (Midpoint), psia:	3,360.00
Storage Capacity, scf/ton:	75.67

G_s Gas Storage Capacity

G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 0.007x + 18.98
R² = 0.982

Pressure/Volume, psia*ton/scf

◆ Measured Data
--- 95% Confidence Interval
— Linear (Measured Data)

Pressure, psia

As-Received Langmuir Isotherm Graph

Storage Capacity, scf/ton

◆ Measured Data
— Langmuir Fit
--- 95% Confidence Interval

Pressure, psia

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Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Velkerri B Shale**
Sample Number:	44569-5M
Sample Type:	shale
Drill Depth, meters:	2,513.70-2,513.73
Temperature, °C:	104.44

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
3.36	0.73	0.67
6.38	1.12	1.11
9.37	1.43	1.45
12.42	1.69	1.72
15.45	1.86	1.95
18.48	2.05	2.13
21.50	2.30	2.29
24.56	2.45	2.42
27.57	2.61	2.54

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	0.2423
Intercept:	4.1942
Regression Coefficient (squared):	0.9828
Intercept Variation, Mpa*gram/scc:	0.5958
Slope Variation, gram/scc:	0.0344
G_{sL} Variation, scc/gram:	0.3813
P_L Variation, MPa:	1.5513
Langmuir Volume, scc/gram:	4.13
Langmuir Pressure, MPa:	17.31
Langmuir Equation:	$V = 4.1 \cdot P / (P + 17.3)$
Pressure (Midpoint), MPa:	23.17
Storage Capacity, scc/gram:	2.36

G_s Gas Storage Capacity

G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 0.242x + 4.194
R² = 0.982

Measured Data
95% Confidence Interval
Linear (Measured Data)

As-Received Langmuir Isotherm Graph

Measured Data
Langmuir Fit
95% Confidence Interval

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