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	3.02	2.86
761.98	5.53	5.66
1,221.30	7.27	7.48
1,677.66	8.64	8.74
2,135.86	9.79	9.68
2,593.23	10.47	10.40

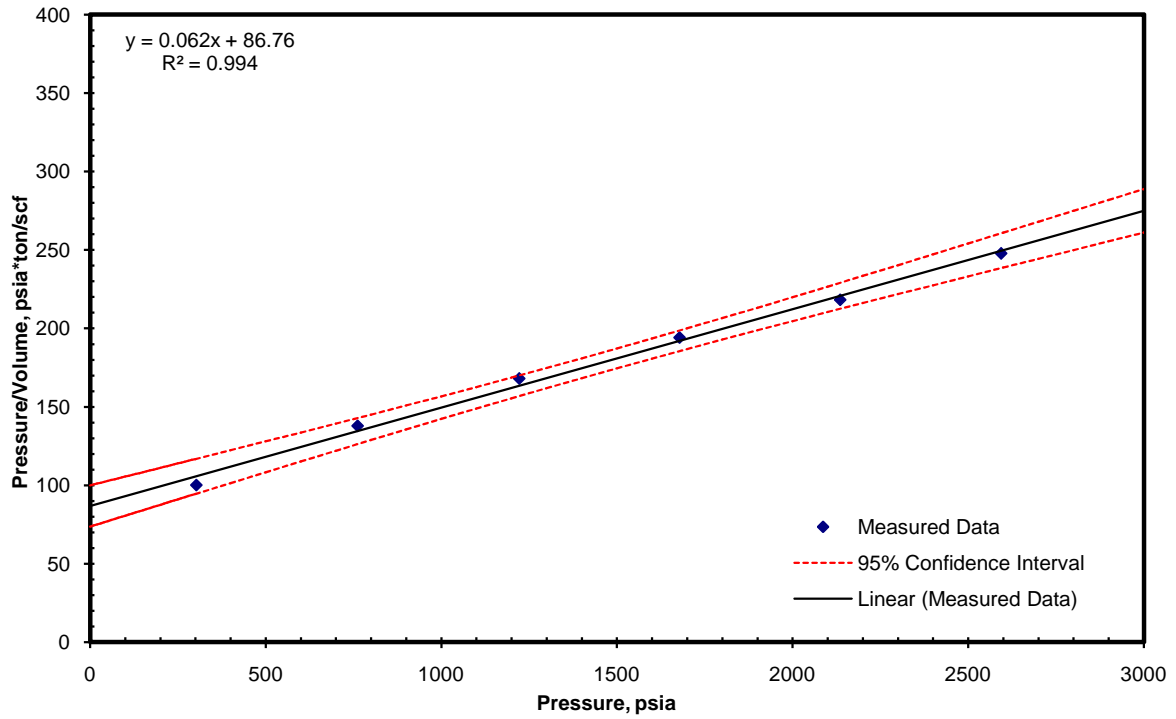| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0627
Intercept:	86.7619
Regression Coefficient (squared):	0.9947
Intercept Variation, psia*ton/scf:	13.1567
Slope Variation, ton/scf:	0.0080
G_{sL} Variation, scf/ton:	0.0022
P_L Variation, psia:	130.2568
Langmuir Volume, scf/ton:	15.94
Langmuir Pressure, psia:	1,383.39
Langmuir Equation:	$G_s = (G_{sL}*p)/(P_L+p)$
Pressure (Midpoint), psia:	2,150.00
Storage Capacity, scf/ton:	9.70

G_s Gas Storage Capacity

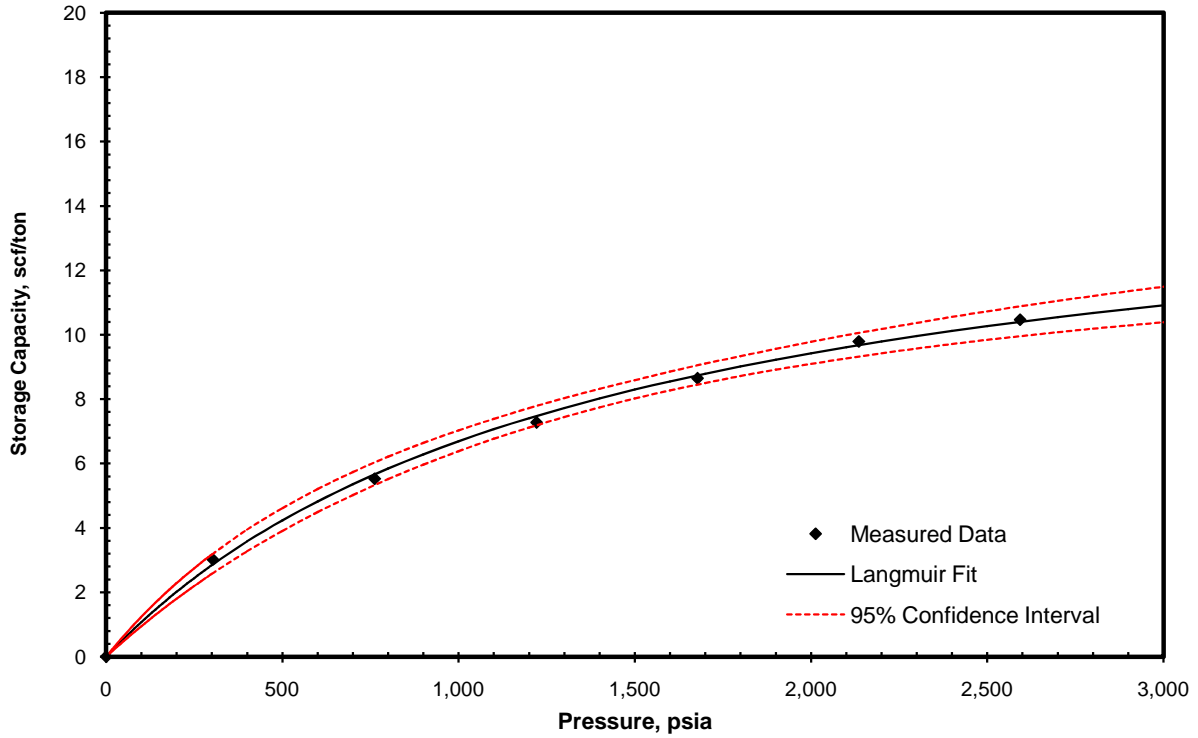G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

$y = 0.062x + 86.76$
$R^2 = 0.994$

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

Pressure/Volume, psia*ton/scf vs *Pressure, psia*

As-Received Langmuir Isotherm Graph

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

Storage Capacity, scf/ton vs *Pressure, psia*

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Methane Adsorption Isotherm Summary

Well:	**Shenandoah No. 1 Australia**
Reservoir:	**Lower Kyalla Shale**
Sample Number:	44569-2M
Sample Type:	shale
Drill Depth, meters:	1590.35-1590.39
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	0.17	0.18
8.42	0.23	0.23
11.57	0.27	0.27
14.73	0.31	0.30
17.88	0.33	0.32

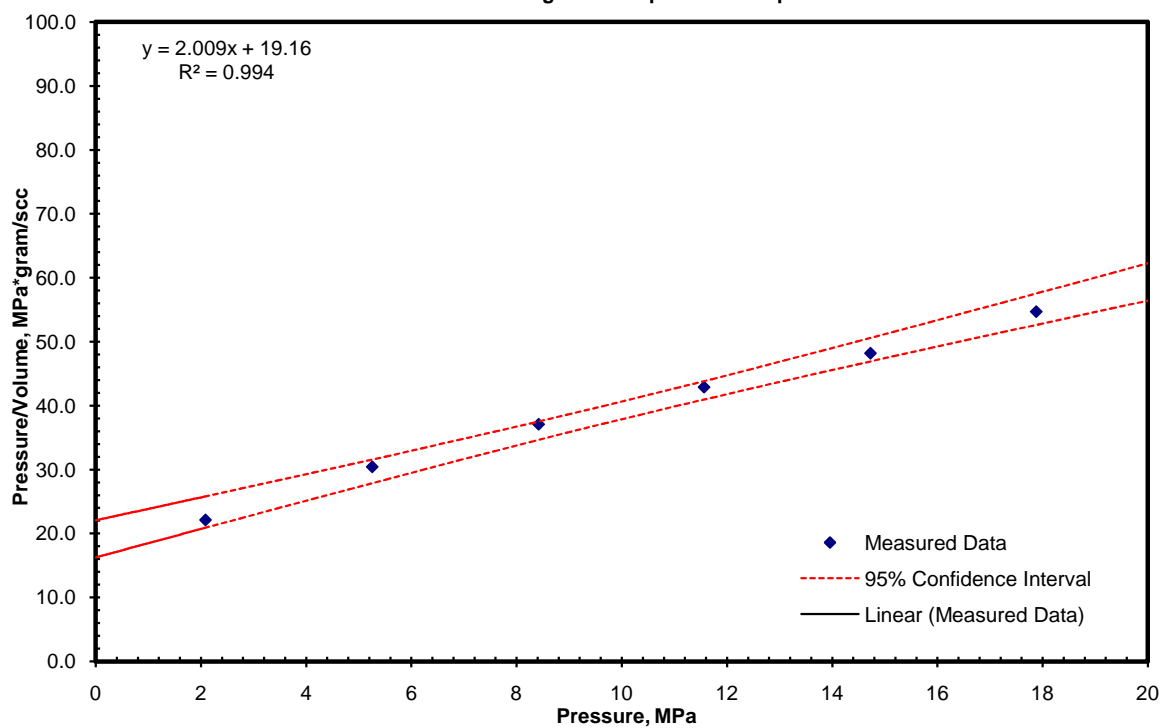| Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	2.0093
Intercept:	19.1645
Regression Coefficient (squared):	0.9947
Intercept Variation, Mpa*gram/scc:	2.9061
Slope Variation, gram/scc:	0.2560
G_{sL} Variation, scc/gram:	0.0001
P_L Variation, MPa:	0.8981
Langmuir Volume, scc/gram:	0.50
Langmuir Pressure, MPa:	9.54
Langmuir Equation:	$V=0.5*P/(P+9.5)$
Pressure (Midpoint), MPa:	14.82
Storage Capacity, scc/gram:	0.30

G_s Gas Storage Capacity

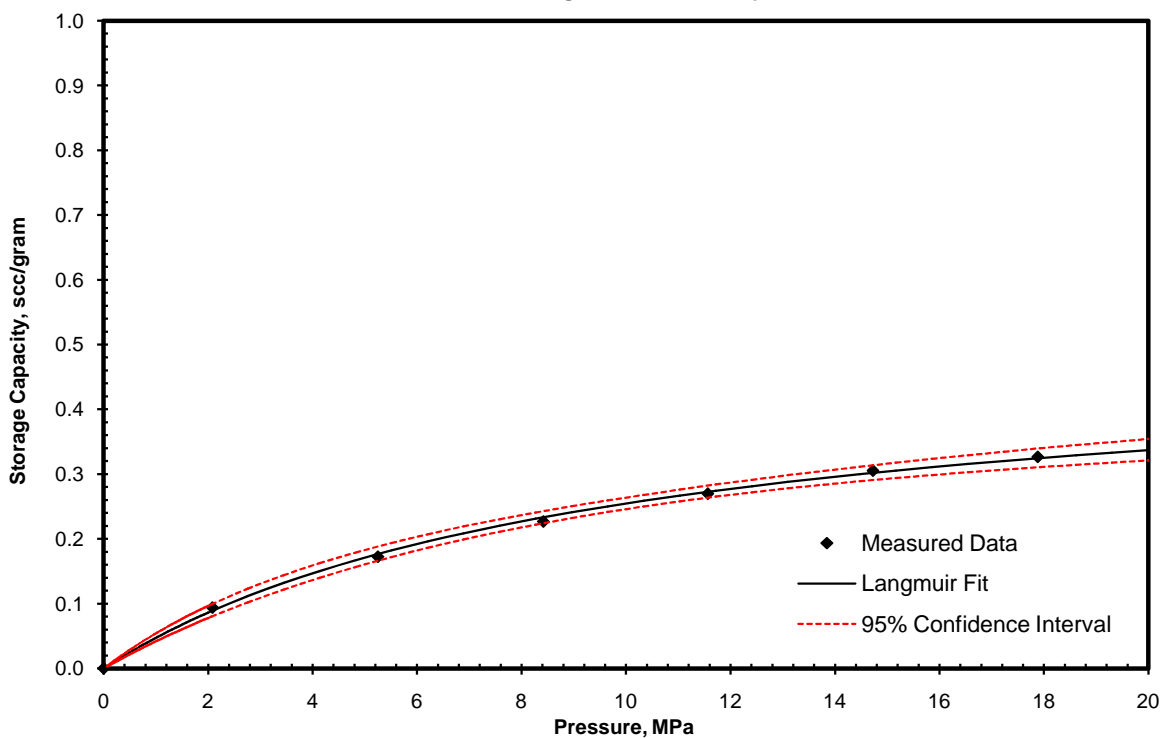G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

$y = 2.009x + 19.16$
$R^2 = 0.994$

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

x-axis: Pressure, MPa
y-axis: Pressure/Volume, MPa*gram/scc

As-Received Langmuir Isotherm Graph

- Measured Data
- Langmuir Fit
- 95% Confidence Interval

x-axis: Pressure, MPa
y-axis: Storage Capacity, scc/gram

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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, °F: 180.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
302.35	1.96	1.97
761.27	4.33	4.34
1,218.39	6.20	6.17
1,679.99	7.67	7.64
2,130.71	8.80	8.83
2,598.91	9.83	9.85

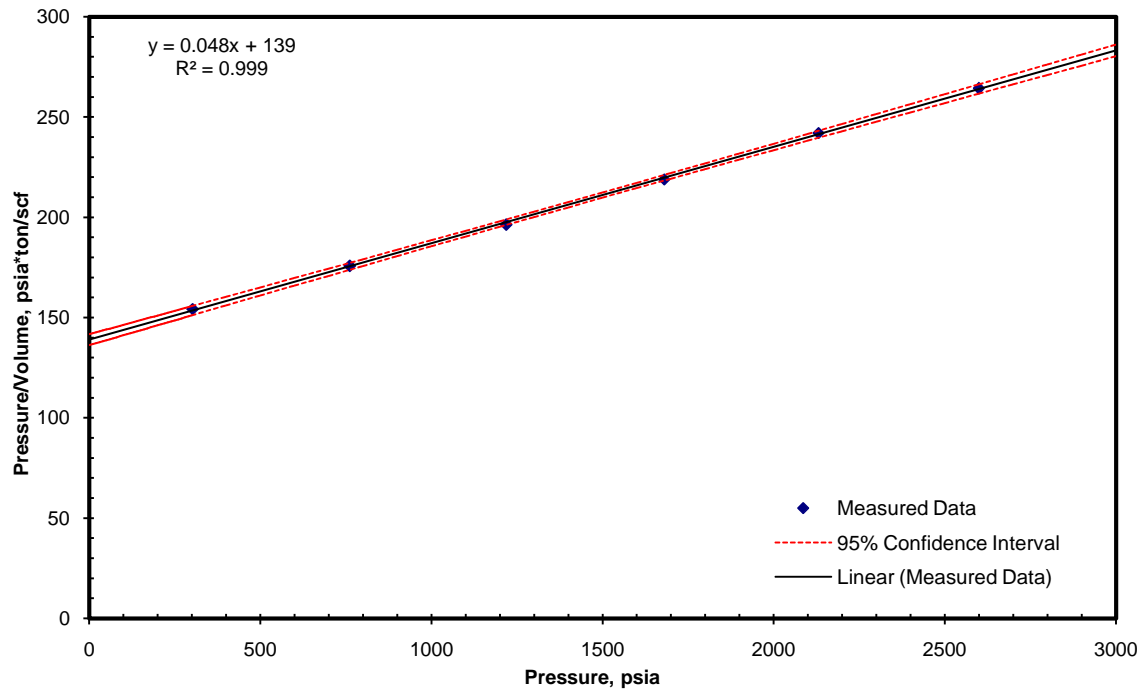| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0481
Intercept:	138.9965
Regression Coefficient (squared):	0.9996
Intercept Variation, psia*ton/scf:	2.7332
Slope Variation, ton/scf:	0.0017
G_{sL} Variation, scf/ton:	0.0008
P_L Variation, psia:	35.2493
Langmuir Volume, scf/ton:	20.80
Langmuir Pressure, psia:	2,891.29
Langmuir Equation:	$G_s = (G_{sL}*p)/(P_L+p)$
Pressure (Midpoint), psia:	2,150.00
Storage Capacity, scf/ton:	8.87

G_s Gas Storage Capacity

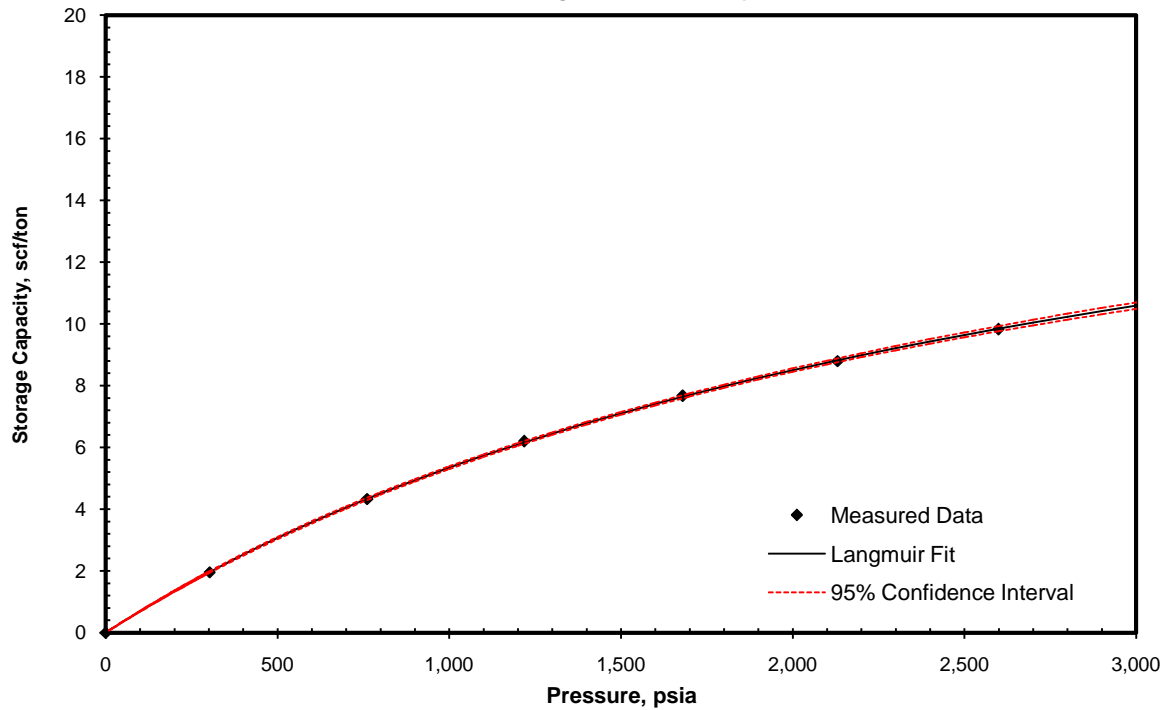G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 0.048x + 139
R² = 0.999

Measured Data
95% Confidence Interval
Linear (Measured Data)

Pressure/Volume, psia*ton/scf

Pressure, psia

As-Received Langmuir Isotherm Graph

Measured Data
Langmuir Fit
95% Confidence Interval

Storage Capacity, scf/ton

Pressure, psia

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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:	1593.08-1593.10
Temperature,°C:	82.22

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
2.08	0.06	0.06
5.25	0.14	0.14
8.40	0.19	0.19
11.58	0.24	0.24
14.69	0.27	0.28
17.92	0.31	0.31

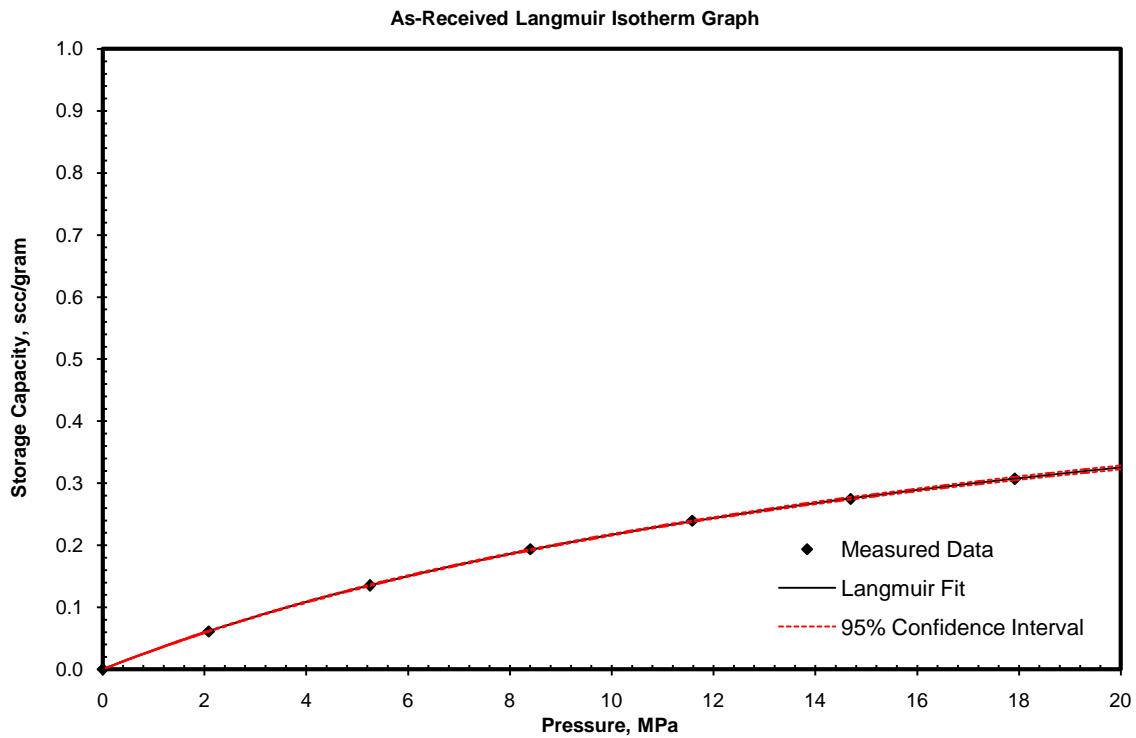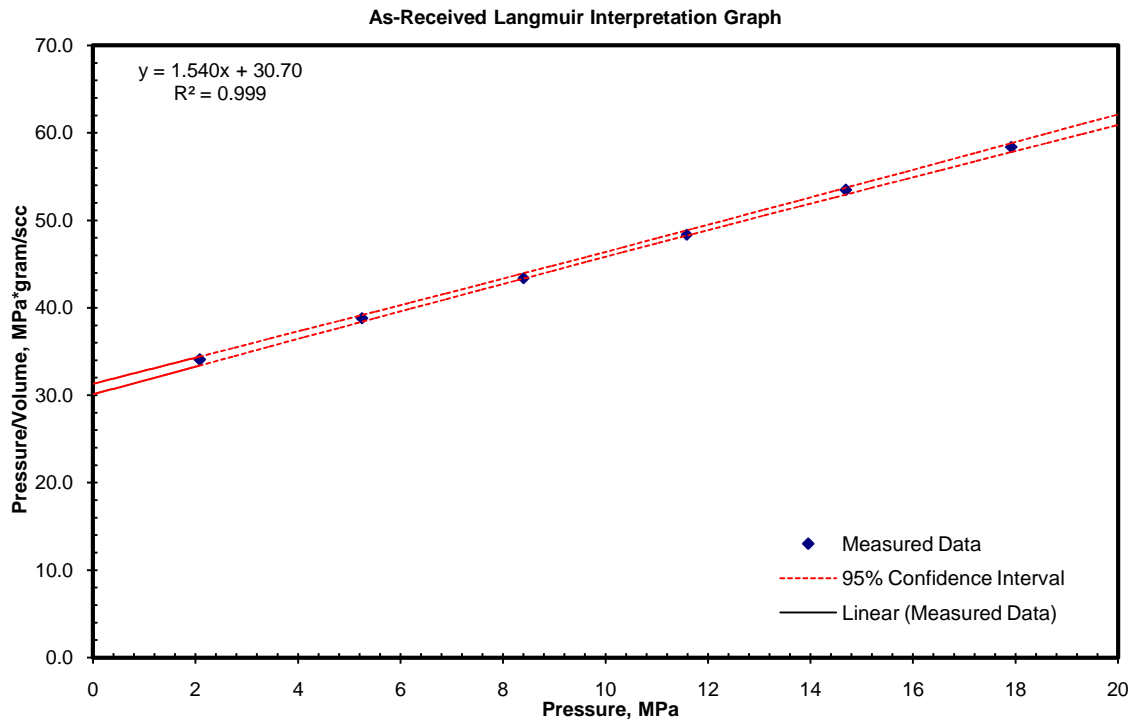| Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	1.5402
Intercept:	30.7024
Regression Coefficient (squared):	0.9996
Intercept Variation, Mpa*gram/scc:	0.6037
Slope Variation, gram/scc:	0.0532
G_{sL} Variation, scc/gram:	0.0000
P_L Variation, MPa:	0.2430
Langmuir Volume, scc/gram:	0.65
Langmuir Pressure, MPa:	19.93
Langmuir Equation:	$V=0.6*P/(P+19.9)$
Pressure (Midpoint), MPa:	14.82
Storage Capacity, scc/gram:	0.28

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 = 1.540x + 30.70
R² = 0.999

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

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

As-Received Langmuir Isotherm Graph

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

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

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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

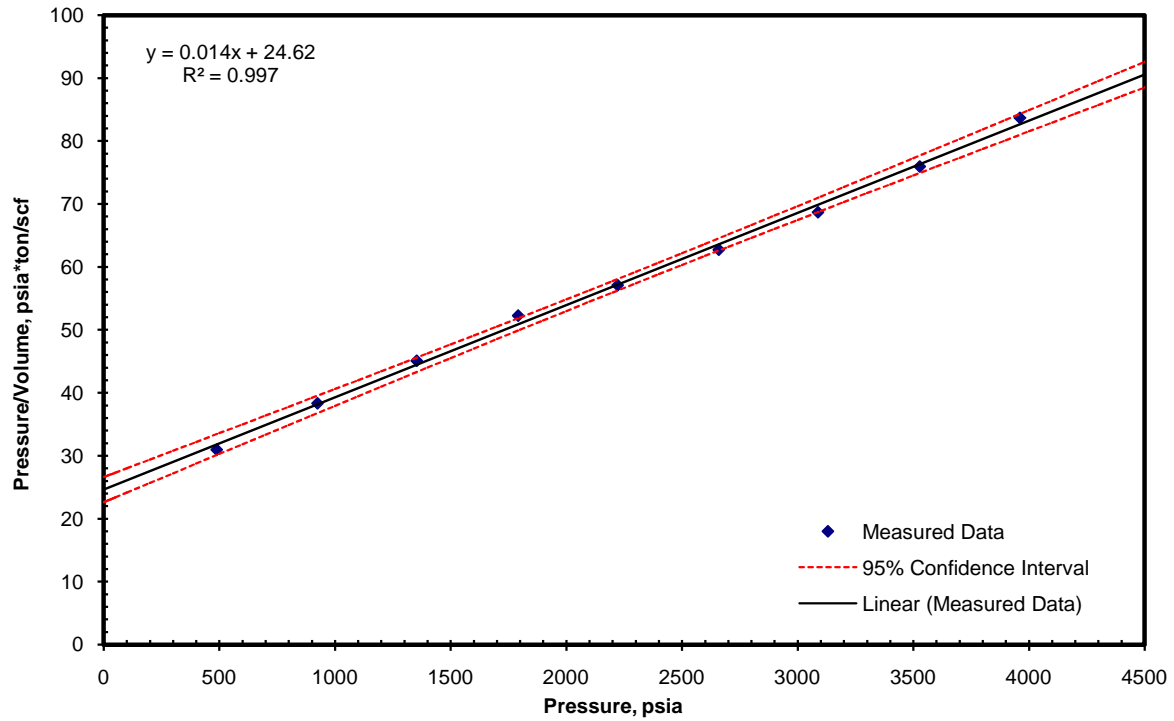| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0147
Intercept:	24.6264
Regression Coefficient (squared):	0.9974
Intercept Variation, psia*ton/scf:	2.0037
Slope Variation, ton/scf:	0.0008
G_{sL} Variation, scf/ton:	0.0569
P_L Variation, psia:	78.9325
Langmuir Volume, scf/ton:	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

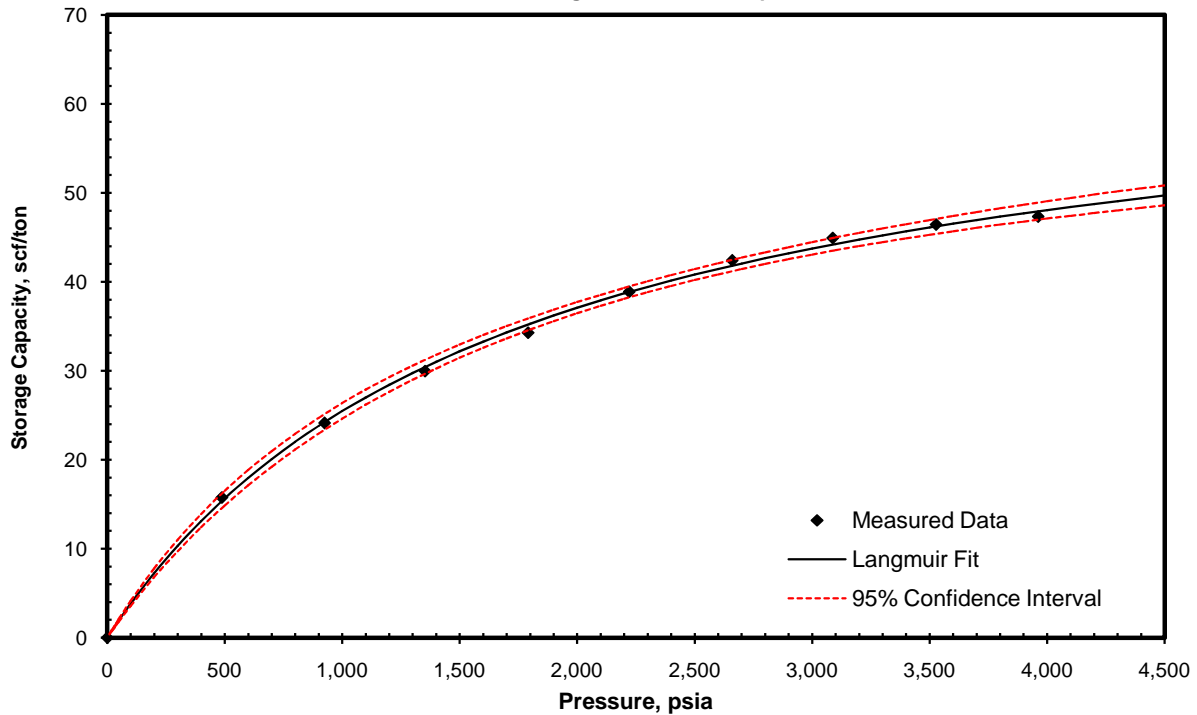G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p   Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

y = 0.014x + 24.62
R² = 0.997

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: 44569-4M
Sample Type: shale
Drill Depth, meters: 2511.83-2511.86
Temperature, °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

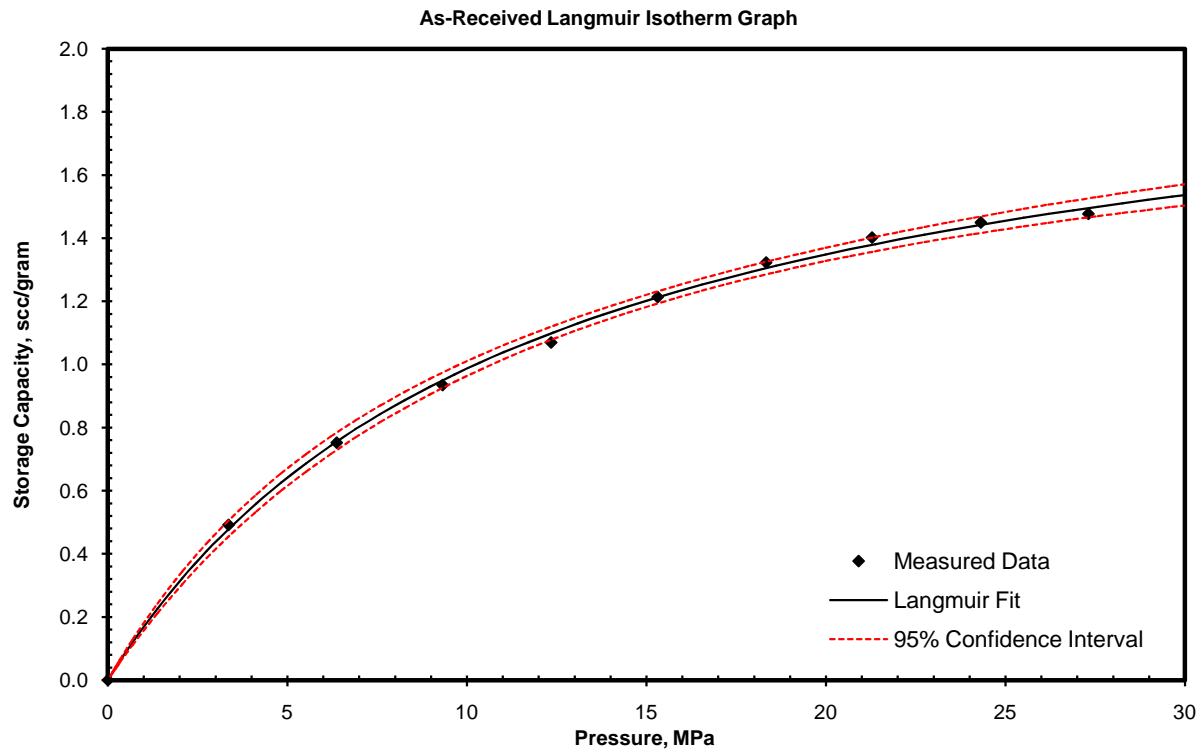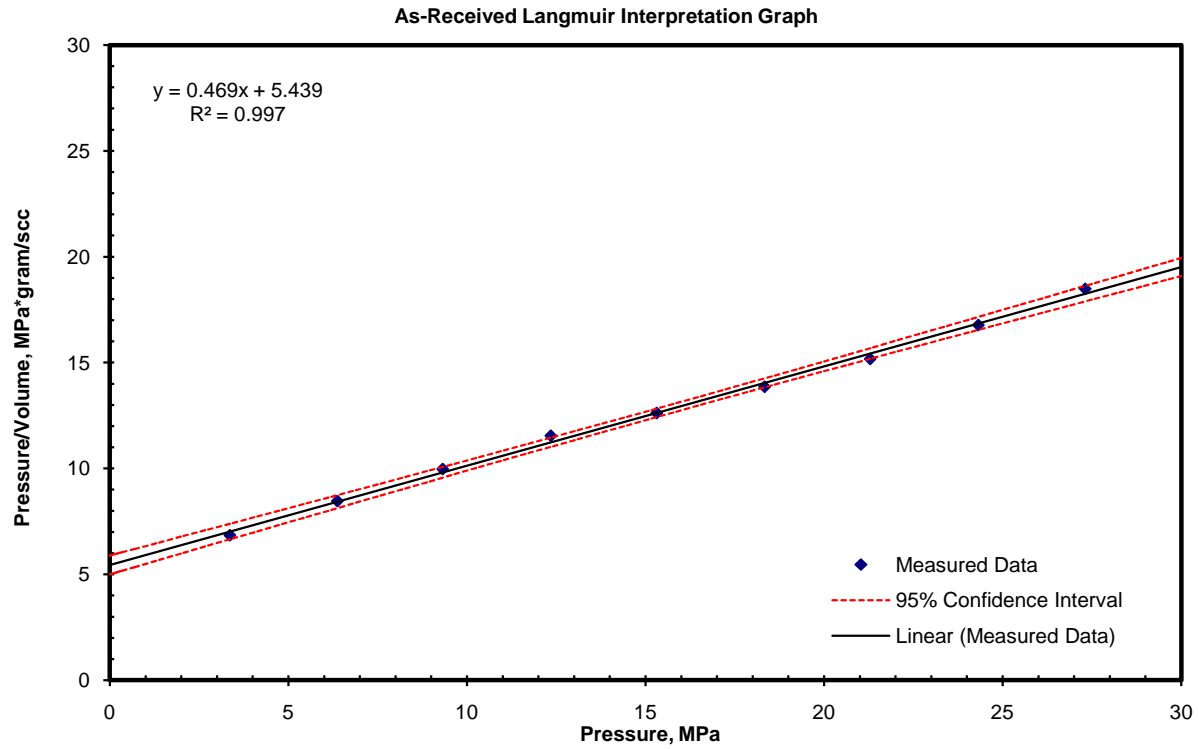| Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	0.4694
Intercept:	5.4396
Regression Coefficient (squared):	0.9974
Intercept Variation, Mpa*gram/scc:	0.4426
Slope Variation, gram/scc:	0.0258
G_{sL} Variation, scc/gram:	0.0018
P_L Variation, MPa:	0.5442
Langmuir Volume, scc/gram:	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
R² = 0.997

Measured Data
95% Confidence Interval
Linear (Measured Data)

Pressure/Volume, MPa*gram/scc

Pressure, MPa

As-Received Langmuir Isotherm Graph

Measured Data
Langmuir Fit
95% Confidence Interval

Storage Capacity, scc/gram

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	22.75
924.65	35.91	36.43
1,359.57	45.86	46.38
1,800.77	54.04	54.07
2,240.52	59.60	60.10
2,680.02	65.72	64.97

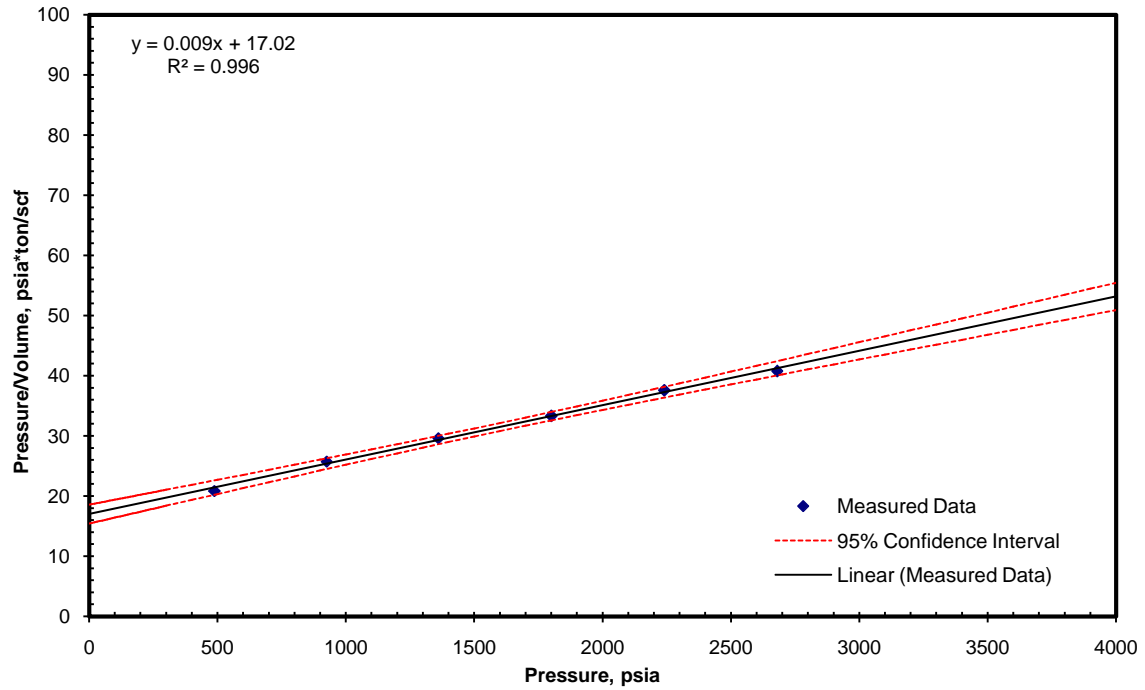| Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0090
Intercept:	17.0237
Regression Coefficient (squared):	0.9968
Intercept Variation, psia*ton/scf:	1.5693
Slope Variation, ton/scf:	0.0009
G_{sL} Variation, scf/ton:	0.1732
P_L Variation, psia:	91.9552
Langmuir Volume, scf/ton:	110.62
Langmuir Pressure, psia:	1,883.22
Langmuir Equation:	$G_s = (G_{sL}*p)/(P_L+p)$
Pressure (Midpoint), psia:	3,360.00
Storage Capacity, scf/ton:	70.89

G_s Gas Storage Capacity

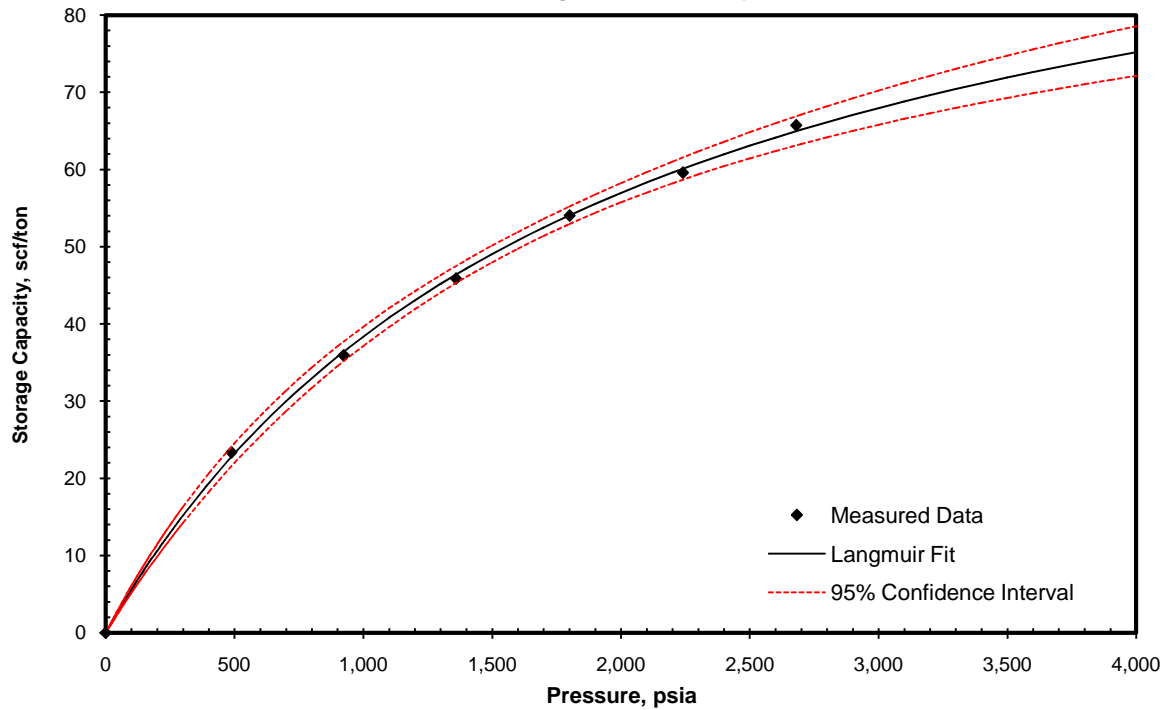G_{sL} Langmuir Gas Storage Capacity

P_L Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

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Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph

$y = 0.009x + 17.02$
$R^2 = 0.996$

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

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

As-Received Langmuir Isotherm Graph

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

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

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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:	2513.82-2513.84
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	0.71
6.38	1.12	1.14
9.37	1.43	1.45
12.42	1.69	1.69
15.45	1.86	1.88
18.48	2.05	2.03

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	0.2896
Intercept:	3.7603
Regression Coefficient (squared):	0.9968
Intercept Variation, Mpa*gram/scc:	0.3466
Slope Variation, gram/scc:	0.0287
G_{sL} Variation, scc/gram:	0.0054
P_L Variation, MPa:	0.6340
Langmuir Volume, scc/gram:	3.45
Langmuir Pressure, MPa:	12.98
Langmuir Equation:	V=3.5*P/(P+13.0)
Pressure (Midpoint), MPa:	23.17
Storage Capacity, scc/gram:	2.21

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 = 0.289x + 3.760
R² = 0.996

As-Received Langmuir Isotherm Graph

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