

Routine Core Analysis Report

Prepared for: Altamont Vecta Oil Gas Ltd Big Sky

Well: Wallewein 22-1

Location: Montana, US

Prepared by:

TerraTek, A Schlumberger company

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Client: Altamont Vecta Oil Gas Ltd Big Sky
Well: Wallewein 22-1
Project No: 811156

Location: Montana, US



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A Schlumberger company
Pioneer Business Park
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Quality Assurance Process

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The lab-generated data undergoes the following five levels of quality checks to establish the integrity of the reported results.

- a) Establish quality of measurement during data generation.
- b) Lab supervisor and manager confirm the overall quality of the generated data.
- c) Project manager reviews and processes generated data and generates reports.
- d) Technical advisors confirm consistency of reported data.
- e) Project manager finalizes reports.

Hence, the completion of each project requires that a qualified and experienced team of engineers perform a variety of independent reviews of all technical data to confirm the consistency and accuracy of the report as per pre-established quality checklists designed for each operation and based on the level of complexity. All property measurements and calculation procedures are maintained in company archives for a period of one year. This information is available for review by clients upon request.

The file and laboratory records information is listed below to provide access reference to all records related to this project. For any questions, please do not hesitate to contact the undersigned project manager.

File No.: 811156

Laboratory Procedures

Alexander Leibold
Routine Core Analysis

Reviewed by

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Project Management

Kelly Vaughn
Core Analysis Manager

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Routine Core Analysis Summary

43 samples from the Wallewein 22-1 well were tested.

The properties of residual fluid saturations, porosity and permeability of the core sample were obtained through basic core analysis specified in the API RP40 method, Recommended Practices for Core Analysis (1998).

All plugs were Dean-Stark extracted to measure fluid saturation. They were then soxhlet cleaned with chloroform/methanol azeotrope to remove hydrocarbons, drilling fluid contamination, and salt. All plugs were dried in convection oven at 104 degC until the weights stabilized. Afterward, they were kept in a desiccant chamber when not being tested. ***Samples 1-30 were cleaned with toluene and then soxhlet cleaned with chloroform/methanol azeotrope. Samples 31-43 were cleaned only with toluene.

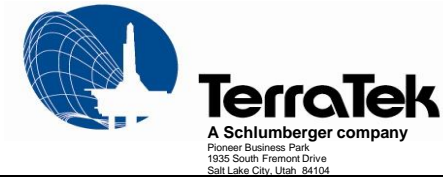
For each sample, steady-state air permeability was measured with nitrogen gas for a single flow rate up to 1 cc/sec at a net confining pressure of 400 psi. Grain volume was measured using helium expansion at ambient conditions based on Boyle's Law. Bulk volume was calculated by measuring the length and width of each plug, a right cylinder. Pore volume was calculated to be the difference between the bulk volume and grain volume. Porosity was calculated to be the pore volume divided by the bulk volume, and the oil and water saturations are the volume of each divided by pore volume.

The routine core properties are summarized in Table 1. The permeability-porosity relationship is shown in Fig. 1. The permeability, porosity, and saturation profiles with depth can be found in Fig. 2 through 4.

Some samples contain gypsum and thus the weight change was less than the total water extracted. This results in a calculated oil saturation of less than 0%. These samples are reported as <0.01%.

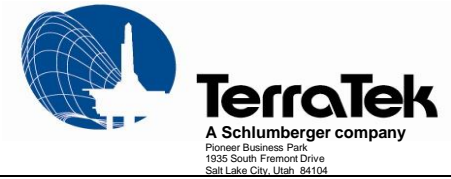
Samples that have fractures which likely gave artificially higher permeability values are: 13, 14, 15, 21, 29, 31B, 33B, 37B and 41B. An attempt was able to be made to heal the fractures with teflon for samples 13, 14, 15, 21, 33B, 41B and could not be attempted for 29, 31B and 37B. A few samples have a lower permeability than the lower resolution of testing ability; these samples are reported as <0.01 mD.

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Sample ID	Sample Depth (ft)	Sample Length (cm)	Sample Diameter (cm)	Bulk Density (g/cc)	Dry Bulk Density (g/cc)	Grain Density (g/cc)	Ambient Porosity (%)	Saturation		Gas Permeability Net Stress 400 PSI (mD)	Lithology
								Water (% PV)	Oil (% PV)		
1	3917.40	2.662	2.540	2.794	2.791	2.869	2.71	5.47	7.08	0.01	dol, gy, xl, sl/ anhy
2	3939.30	2.607	2.539	2.786	2.778	2.876	3.43	11.04	16.10	<0.01	dol, dk gy-gy, f gr, sl/ lam
3	3945.60	2.600	2.540	2.808	2.807	2.858	1.79	0.43	6.50	<0.01	dol, gy & lt gy, xl, sl/ vgy
4	3947.20	2.590	2.541	2.746	2.744	2.869	4.37	0.02	5.93	0.02	dol, gy-brn, f gr, anhy
5	3950.70	2.569	2.540	2.817	2.816	2.887	2.45	0.03	5.49	<0.01	anhy dol, gy, xl, vgy
6	3979.12	2.596	2.543	2.691	2.646	2.870	7.79	53.55	4.93	0.41	dol, lt gy, slit, sl/ anhy, dk gy lam
7	3981.70	2.586	2.540	2.792	2.782	2.884	3.55	12.89	17.94	<0.01	anhy dol, gy, xl
8	3995.50	2.598	2.543	2.782	2.778	2.879	3.53	2.15	12.63	0.02	dol, gy, f gr, pof
9	4015.10	2.642	2.541	2.766	2.756	2.876	4.17	16.12	11.17	<0.01	dol, lt gy-lt brn, xl, anhy
10	4022.50	2.657	2.539	2.723	2.713	2.877	5.71	13.03	5.67	0.03	dol, lt gy-lt brn, f gr, anhy
11	4039.68	2.629	2.541	2.640	2.591	2.876	9.91	51.44	<0.01	0.67	dol, lt gy, f gr-slit, anhy, gy lam
12	4040.38	2.644	2.541	2.666	2.641	2.861	7.71	46.41	<0.01	0.10	dol, gy, f gr, sl/ calc, lam
13	4041.00	2.606	2.540	2.569	2.546	2.862	11.05	21.25	<0.01	4.56	dol, gy-brn, f gr, frac
14	4041.80	2.591	2.537	2.630	2.615	2.890	9.51	8.83	8.22	4.44	dol, gy-brn & wh, f gr, anhy, aff, frac
15	4043.68	2.591	2.540	2.635	2.628	2.869	8.41	2.72	6.07	1.09	dol, gy-brn, f gr, pof, cff, frac
16	4045.60	2.581	2.540	2.681	2.680	2.874	6.74	0.00	1.33	0.16	dol, gy-brn, f gr, sl/ anhy, sl/ vgy, pof
17	4046.50	2.614	2.540	2.635	2.633	2.873	8.37	0.01	3.17	0.22	dol, gy-brn, f gr, sl/ anhy, vgy
18	4049.80	2.619	2.540	2.657	2.651	2.859	7.26	3.12	6.60	0.10	dol, gy-brn, f gr, sl/ anhy
19	4050.28	2.609	2.540	2.656	2.645	2.855	7.35	9.26	6.29	0.27	dol, gy-brn, f gr, sl/ anhy, sl/ lam
20	4051.40	2.626	2.541	2.625	2.619	2.857	8.33	0.90	7.84	0.49	dol, gy-brn, f gr, sl/ anhy, sl/ vgy
21	4052.76	2.620	2.540	2.757	2.756	2.865	3.80	0.20	2.56	3.82	dol, gy, f gr, anhy, sl/ vgy, aff, frac
22	4053.87	2.614	2.541	2.712	2.706	2.860	5.41	9.75	2.13	0.21	dol, dk brn-gy, f-m gr, anhy, sl/ vgy, sl/ lam, pof
23	4054.82	2.620	2.540	2.623	2.620	2.862	8.44	0.01	2.93	0.92	dol, dk brn-gy, f-m gr, anhy, vgy
24	4057.10	2.652	2.543	2.681	2.678	2.863	6.47	0.01	5.79	0.25	dol, gy-brn, f-m gr, anhy, vgy
25	4063.06	2.598	2.541	2.664	2.663	2.875	7.39	0.00	1.81	2.10	dol, gy-brn, f gr, sl/ anhy, sl/ vgy, lam

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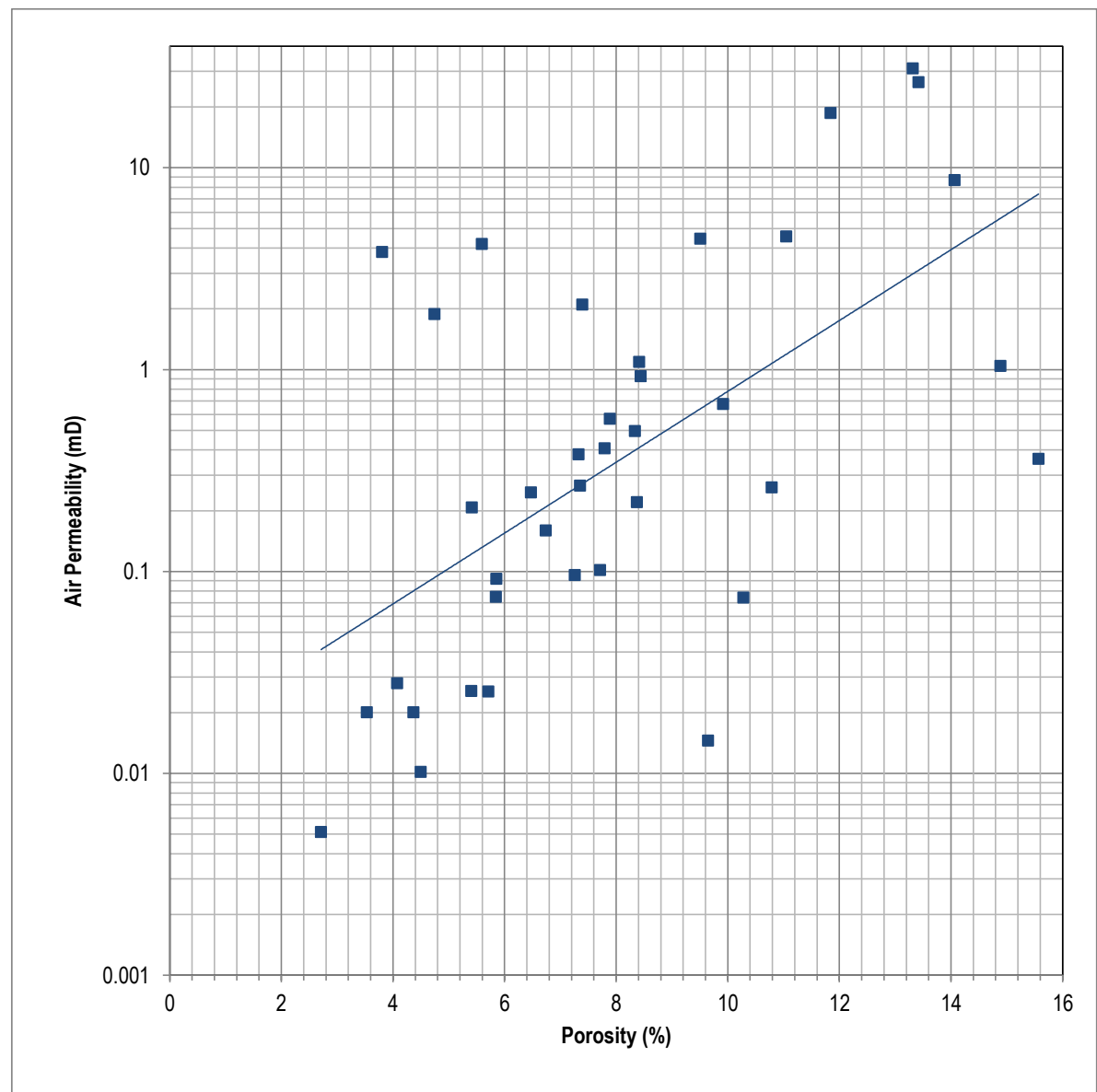
Sample ID	Sample Depth (ft)	Sample Length (cm)	Sample Diameter (cm)	Bulk Density (g/cc)	Dry Bulk Density (g/cc)	Grain Density (g/cc)	Ambient Porosity (%)	Saturation		Gas Permeability Net Stress 400 PSI (mD)	Lithology
								Water (% PV)	Oil (% PV)		
26	4064.40	2.609	2.540	2.524	2.523	2.862	11.84	0.01	1.27	18.6	dol, lt brn-gy, f-m gr, vgy, lam
27	4065.75	2.553	2.543	2.697	2.693	2.860	5.84	1.32	6.99	0.07	dol, gy, f gr, sl/ vgy, lam, pof
28	4071.80	2.609	2.543	2.740	2.740	2.869	4.50	0.17	0.79	0.01	dol, gy-lt brn, f gr, sl/ anhy, sl/ vgy
29	4081.20	2.639	2.541	2.718	2.715	2.883	5.85	0.00	6.46	0.09	anhy dol, gy-brn, f gr
30	4105.75	2.639	2.541	2.715	2.708	2.862	5.40	8.30	6.99	0.03	dol, gy-lt gy, f gr, anhy
31B	4109.00	2.558	2.539	2.755	2.754	2.891	4.74	1.14	3.26	1.88	anhy dol, brn-gy & wh, f gr, sl/ vgy, pof
32B	4117.50	2.584	2.540	2.584	2.547	2.855	10.79	42.47	<0.01	0.26	dol, gy-lt gy, f-m gr, gyp, anhy, sl/ vgy, sl/ lam
33B	4118.40	2.623	2.540	2.508	2.428	2.853	14.88	56.62	<0.01	1.04	dol, lt gy-lt brn, f gr, gyp, anhy, sl/ vgy, sl/ lam, frac
34B	4119.30	2.620	2.537	2.446	2.420	2.866	15.57	22.79	<0.01	0.36	dol, gy-lt brn, f-m gr, gyp, anhy, vgy, sl/ lam
35B	4120.70	2.572	2.537	2.480	2.454	2.855	14.06	30.35	<0.01	8.65	dol, brn-gy, f-m gr, gyp, anhy, vgy
36B	4123.90	2.592	2.537	2.648	2.647	2.856	7.33	0.21	1.72	0.38	dol, gy-dk gy, f-m gr, sl/ calc, sl/ anhy, sl/ gyp, vgy, sl/ lam
37B	4131.70	2.576	2.536	2.493	2.483	2.864	13.32	8.08	<0.01	30.9	dol, dk gy-brn, f-m gr, anhy, gyp, vgy, pof
38B	4133.00	2.579	2.540	2.648	2.627	2.852	7.89	46.56	<0.01	0.57	dol, lt gy-gy, f-m gr, anhy, gyp, sl/ vgy, sl/ lam, aff, gypff
39B	4137.60	2.606	2.540	2.727	2.706	2.866	5.59	53.51	<0.01	4.18	anhy dol, gy & lt gy, f-m gr, gyp, sl/ vgy, lam, aff
40B	4139.30	2.578	2.543	2.742	2.739	2.855	4.08	3.75	4.19	0.03	dol, gy, f gr, sl/ gyp, sl/ anhy, sl/ vgy
41B	4140.40	2.560	2.539	2.504	2.478	2.862	13.42	23.29	<0.01	26.4	dol, lt gy-brn, f-m gr, gyp, anhy, vgy, sl/ lam, frac
42B	4142.90	2.560	2.543	2.582	2.581	2.857	9.65	0.16	0.75	0.01	dol, gy, f gr, anhy, sl/ gyp, sl/ vgy
43B	4143.50	2.548	2.541	2.569	2.568	2.862	10.28	0.04	0.84	0.07	dol, gy, f gr, sl/ anhy, sl/ gyp, sl/ vgy

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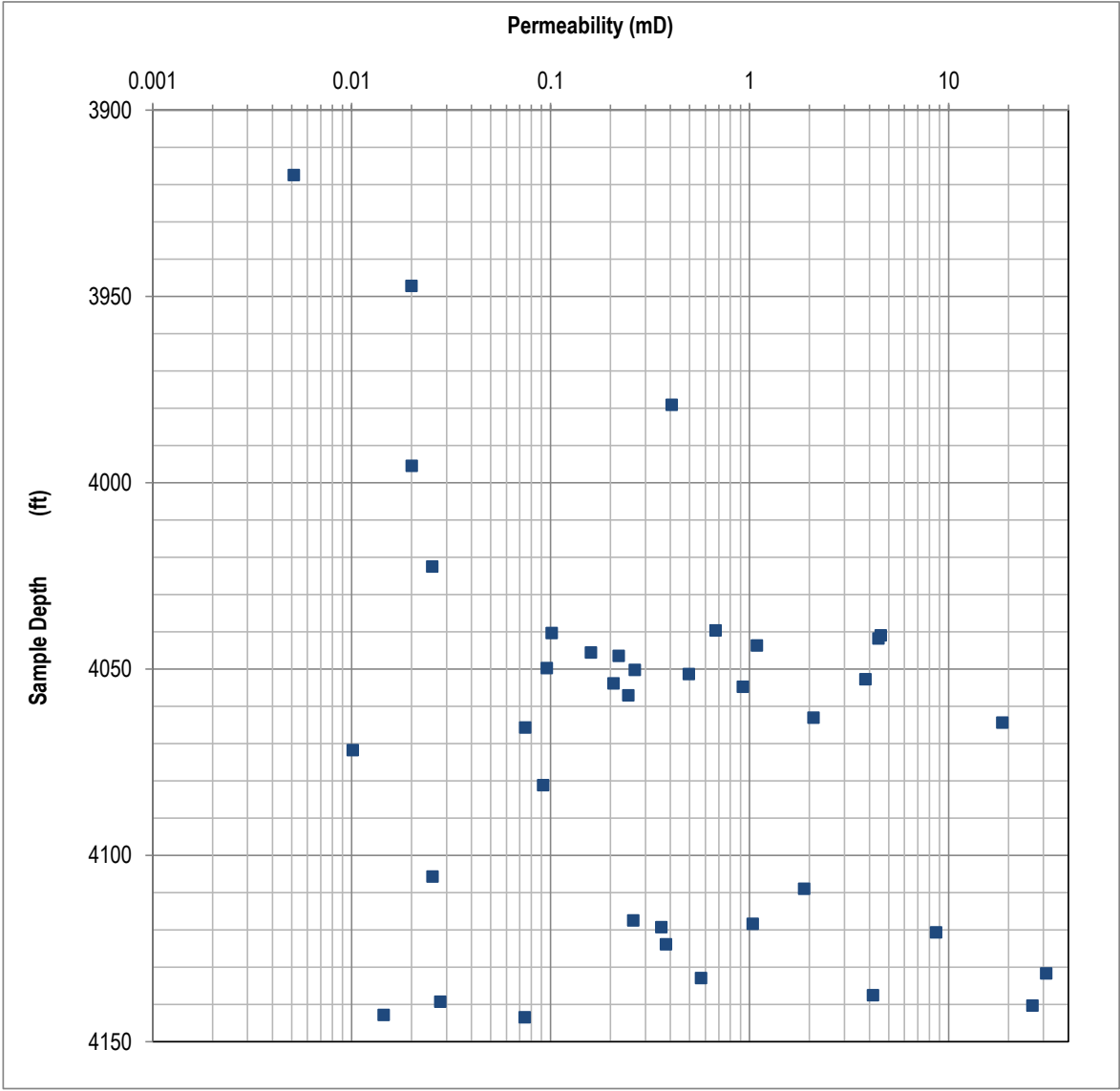
Figure 1. Permeability v. Porosity Cross Plot



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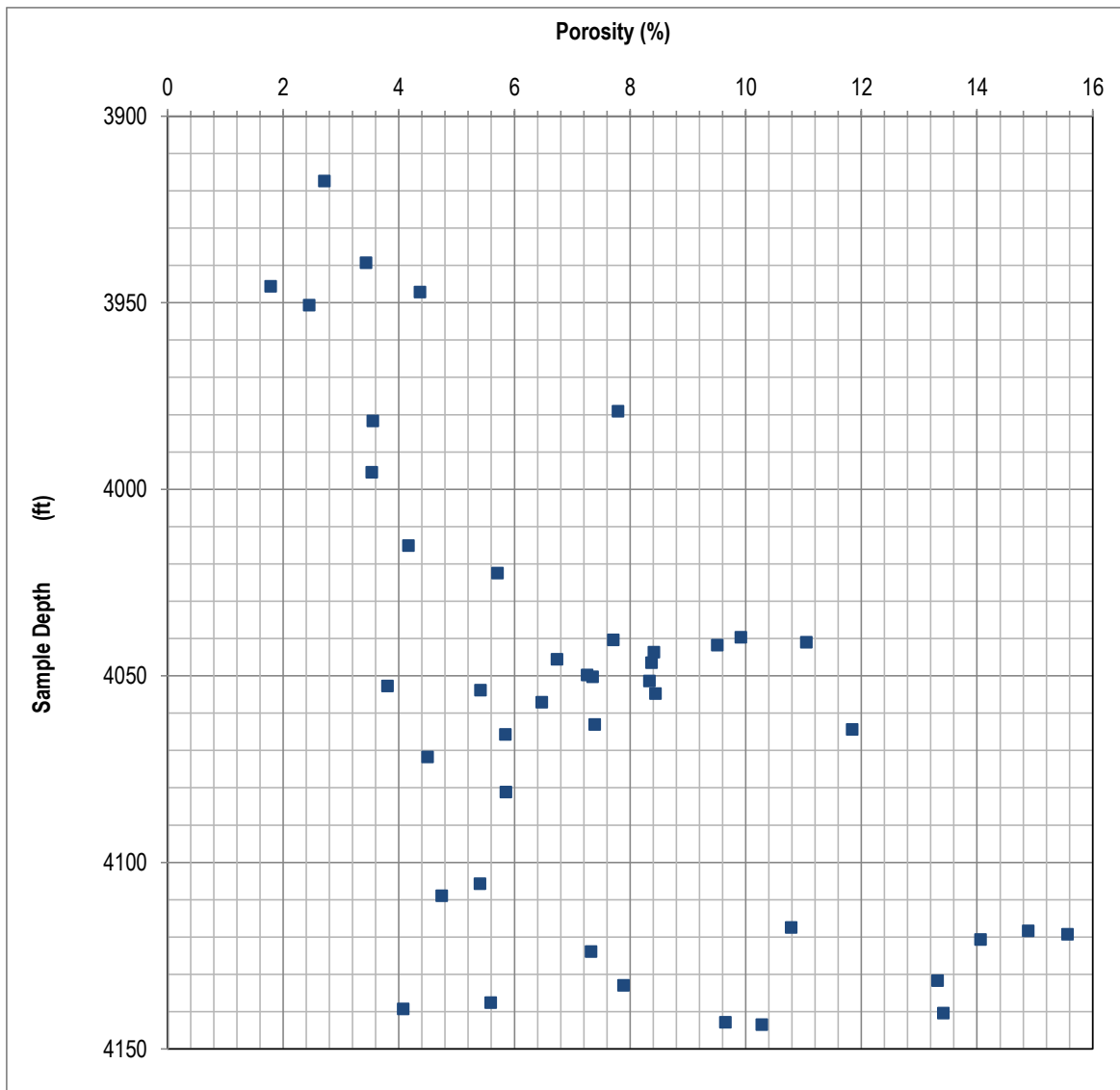
Figure 2. Permeability Profile v. Depth



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Figure 3. Porosity Profile v. Depth



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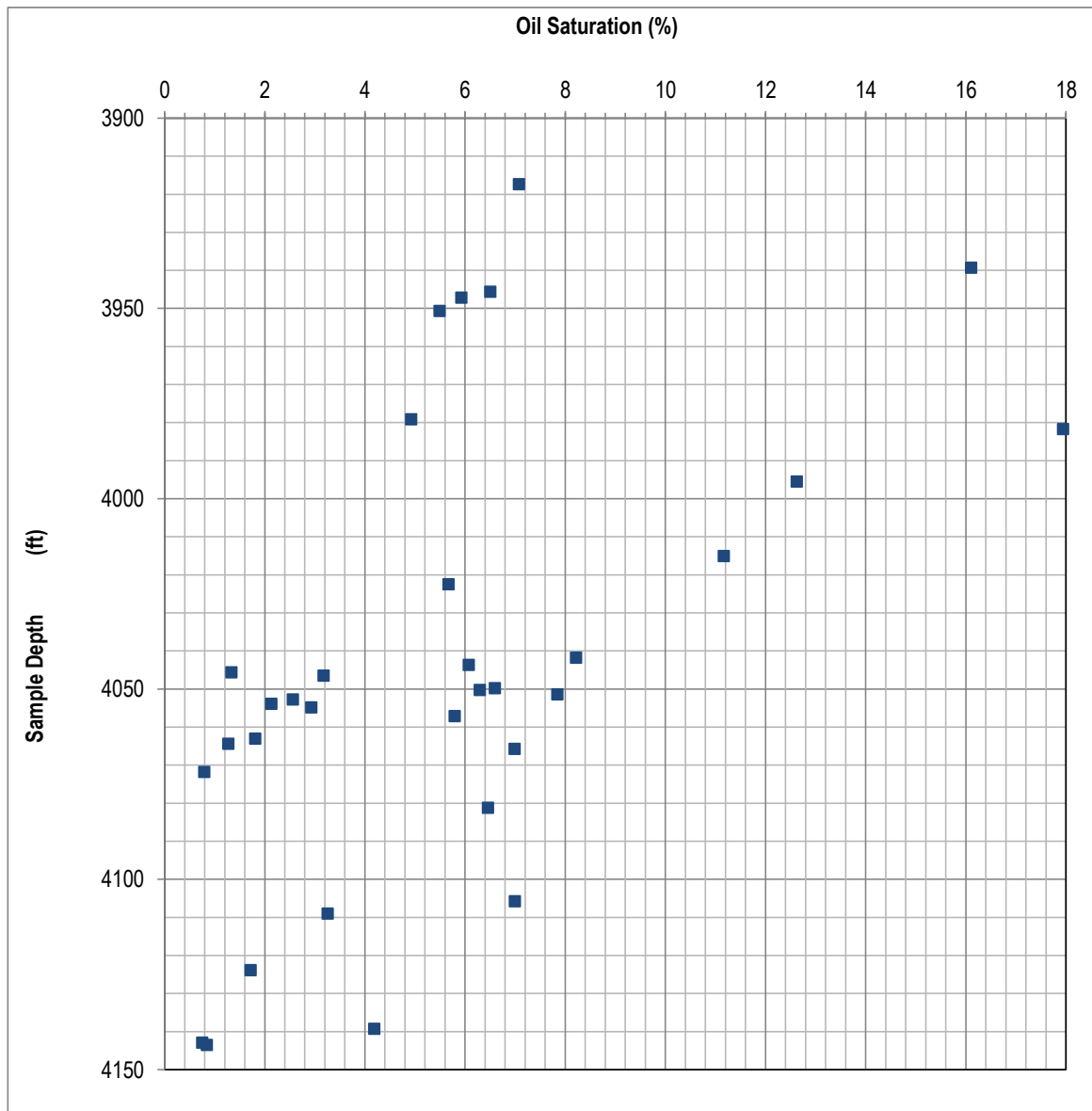
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Figure 4. Saturation Profile v. Depth



Description Scheme for Carbonate Sedimentary Rocks:

Rock Type, Color, Grain Size or Crystal Size, Porosity Type, Accessories

Description Scheme for Clastic Sedimentary Rocks:

Rock Type, Color, Grain Size, Cement, Structures and Accessories

Key to Abbreviations:

aff	- anhydrite filled fracture	grnl	- granule	sdv	- sandy
alt	- altered	gy	- gray	sh	- shale
anhy	- anhydrite(ic)	gyp	- gypsum(iferous)	shy	- shaley
arg	- argillaceous	gypff	- gypsum filled fracture	sid	- siderite
bdd	- bedded	hem	- hematite(ic)	sil	- silica(eous)
bent	- bentonite	if	- incipient fracture	sl/	- slightly
bf	- buff	incl	- inclusion	sltst	- siltstone
biot	- bioturbated	intprt	- interparticle	slt	- silt
bit	- bitumen	intrprt	- intraparticle	slty	- silty
bl	- blue(ish)	intxl	- intercrystalline	ss	- sandstone
blk	- black	lam	- laminated	stn	- stain(ed)(ing)
bnd	- banded	lav	- lavender	str	- streak
brec	- breccia(ted)	lig	- lignite(ic)	styl	- stylolite
brn	- brown(ish)	ls	- limestone	suc	- sucrosic
bur	- burrowed	lt	- light	tan	- tan
c	- coarse	m	- medium	v/	- very
calc	- calcite(areous)	mar	- maroon	vc	- very coarse
carb	- carbonaceous	mas	- massive	vf	- very fine
cff	- calcite filled fracture	mdy	- muddy	vgy	- vuggy
cgl	- conglomerate	mic	- micro	wh	- white
chky	- chalky	mc	- micro-crack	wthrd	- weathered
chlor	- chlorite	mnr	- minor	wvy	- wavy
cht	- chert	mica	- micaceous	yel	- yellow
chty	- cherty	mol	- moldic	xl	- crystalline
clst	- clast	ms	- mudstone		
cly	- clay(ey)	mtx	- matrix		
clyst	- claystone	nod	- nodule(s)		
cob	- cobble	o	- oil		
dism	- disseminated	of	- open fracture		
dk	- dark	ool	- oolitic		
dff	- dolomite filled	org	- organic		
frac	- fracture	ormg	- orange		
dol	- dolomite(ic)	pbl	- pebble		
f	- fine	pel	- peloids		
fen	- fenestral	pff	- pyrite filled fracture		
fis	- fissile	pis	- pisolitic		
flu	- fluorescence	pk	- pink		
fos	- fossil(iferous)	pof	- partially open fracture		
frac	- fracture	ppvgs	- pinpoint vugs		
fri	- friable	ptg	- parting(s)		
gff	- gouge filled fracture	purp	- purple		
glauc	- glauconitic	pyr	- pyrite(ic)		
gn	- green	qff	- quartz filled fracture		
grdd	- graded	qtz	- quartz		
gr	- grain(ed)	red	- red(dish)		
		sa	- salty		