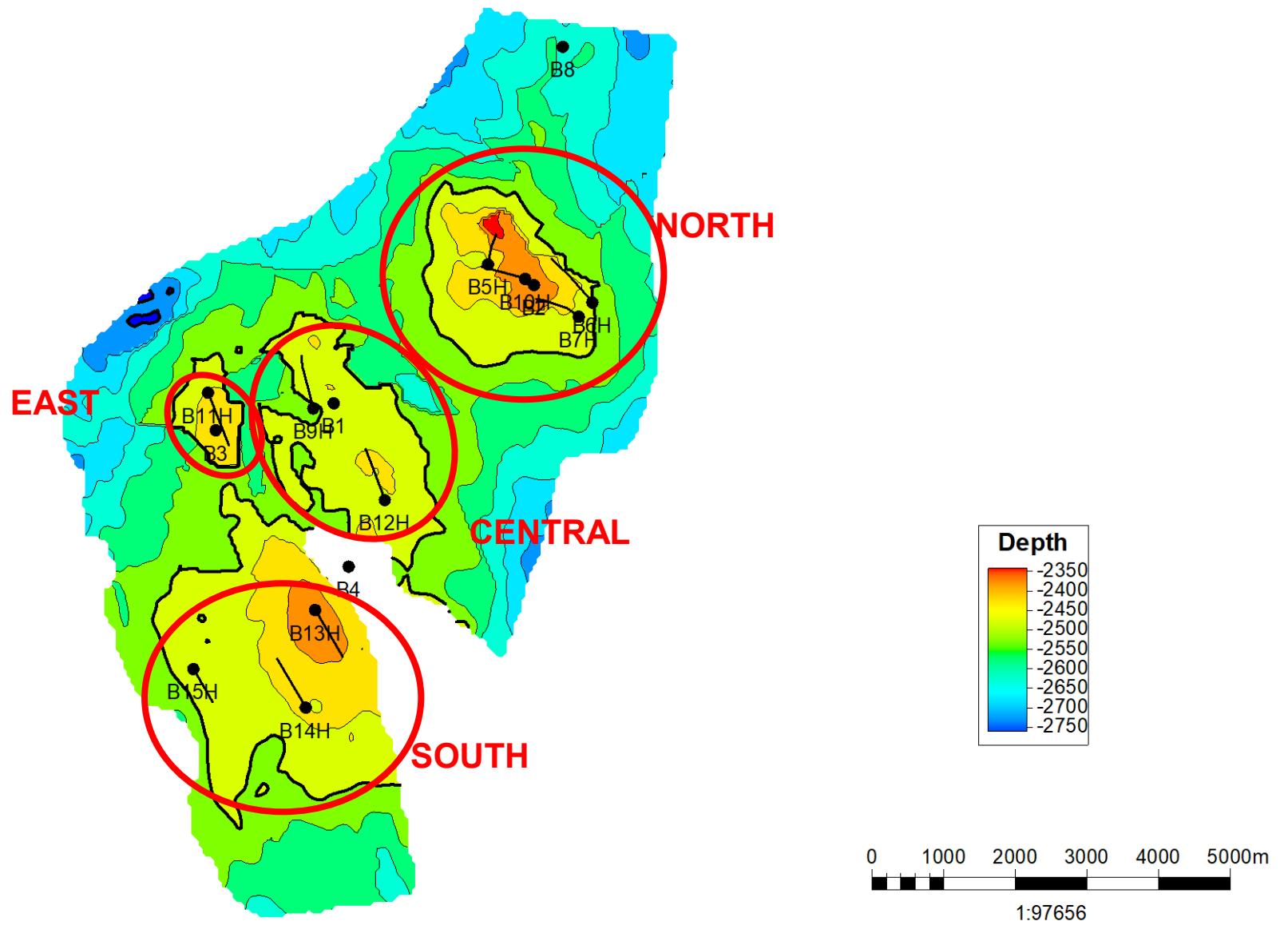


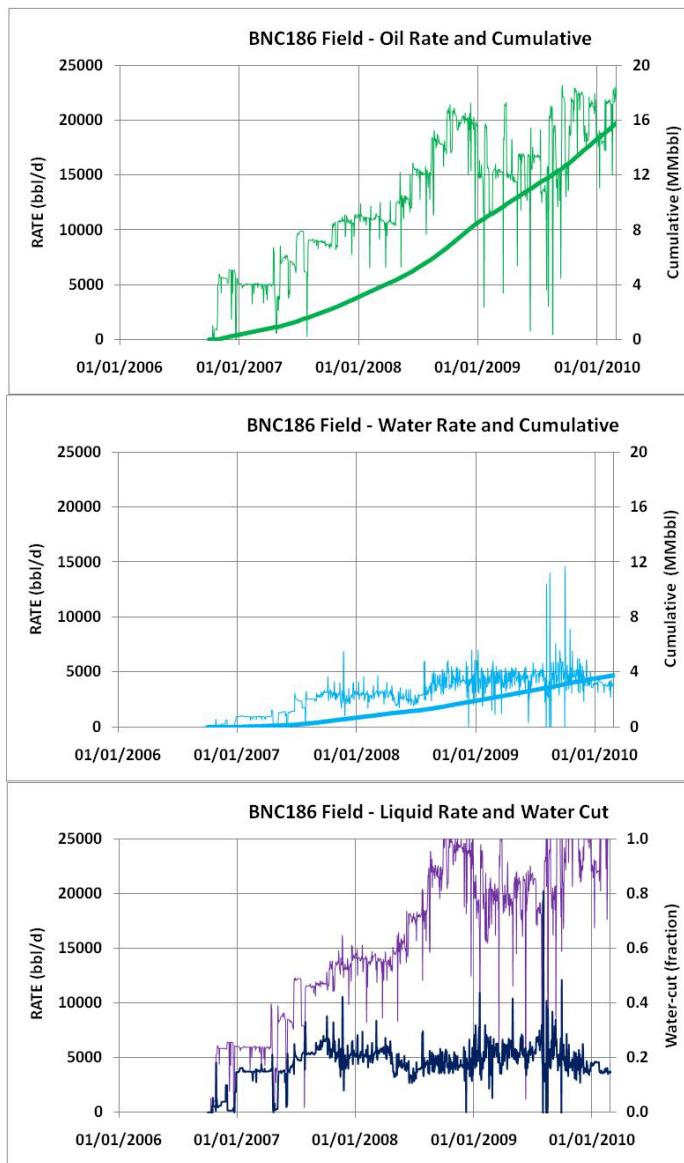
	CCA	RFT/XPT	Pressure	PVT	Water Properties	Production	WT		PLT		MUDLOSS		
							Report	Ascii	Report	Ascii	Information	Ascii	Well sketch
B1	Y	Y	Y			Y	Y				Y		Y
B2	Y	Y	Y	Y		Y	Y				Y		Y
B3		Y	Y			Y	Y				Y		Y
B5P		Y											
B5H			Y		Y	Y					Y		Y
B6P													
B6H			Y		Y	Y			Y	Y	Y		Y
B7P													
B7H			Y		Y	Y	Y		Y	Y			Y
B8	Y												
B9P													
B9H			Y		Y	Y	Y				Y		Y
B10H			Y			Y	Y				Y		Y
B11H			Y			Y	Y		Y	Y			Y
B12H			Y		Y	Y	Y		Y	Y			Y
B13P												Y	
B13H		Y	Y			Y					Y		Y
B14P	Y										Y		
B14H		Y	Y			Y	Y				Y		Y
B15P													
B15H		Y	Y			Y	Y						Y
TOTAL	4	7	13	1	5	13	10	0	4	4	11	0	13

Fig. 5.1

Data available for the dynamic characterization

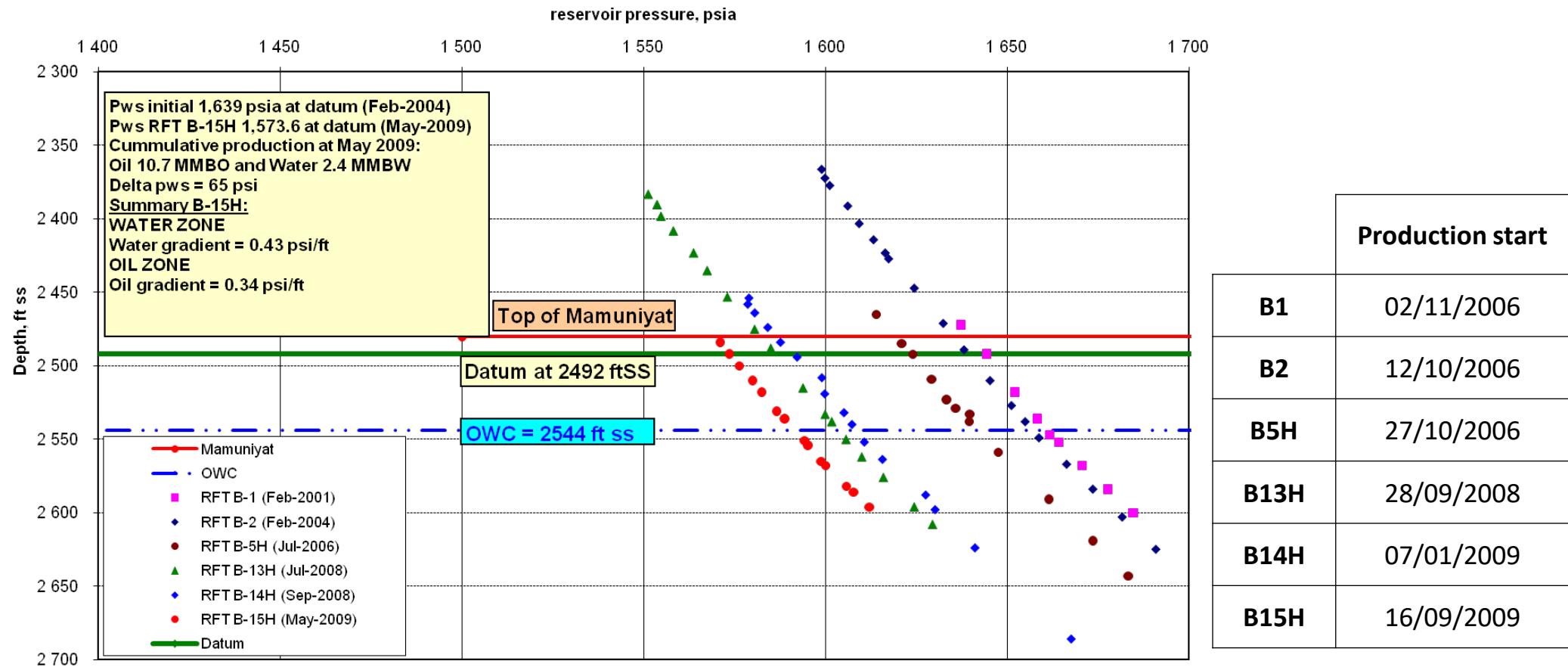


Well location map (Petrel model)

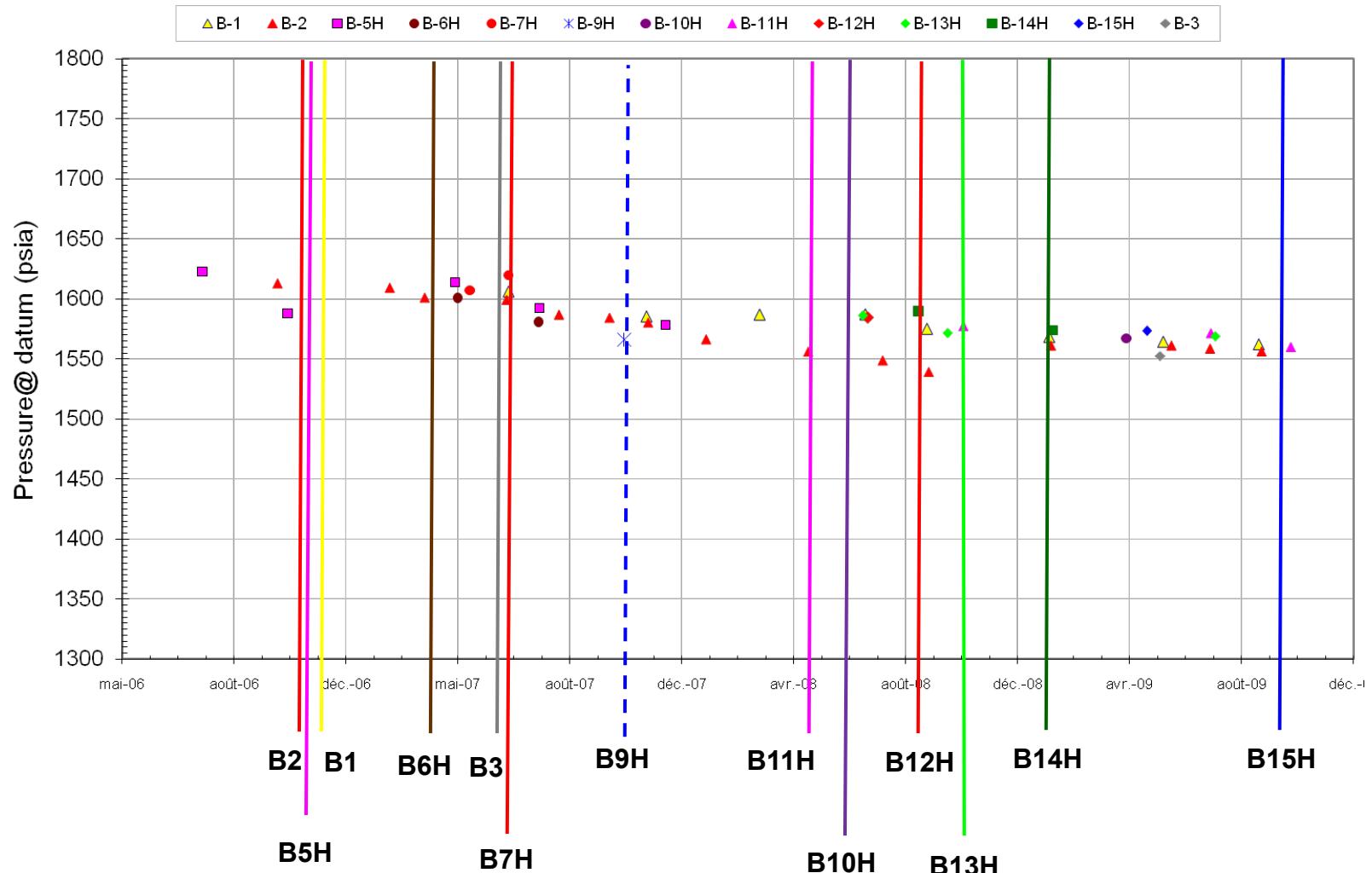


Production profiles of B-NC186 Field

RFT data in B Field NC-186 with B-15H in May 2009

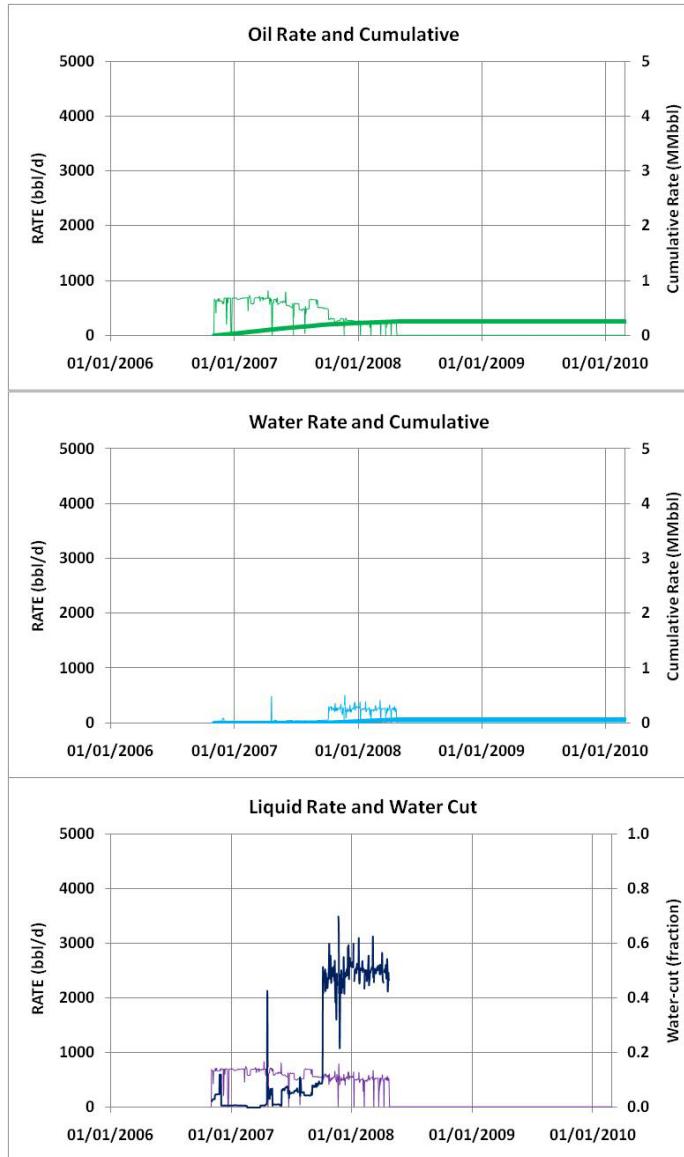


B-NC186 Field. Pressure Monitoring

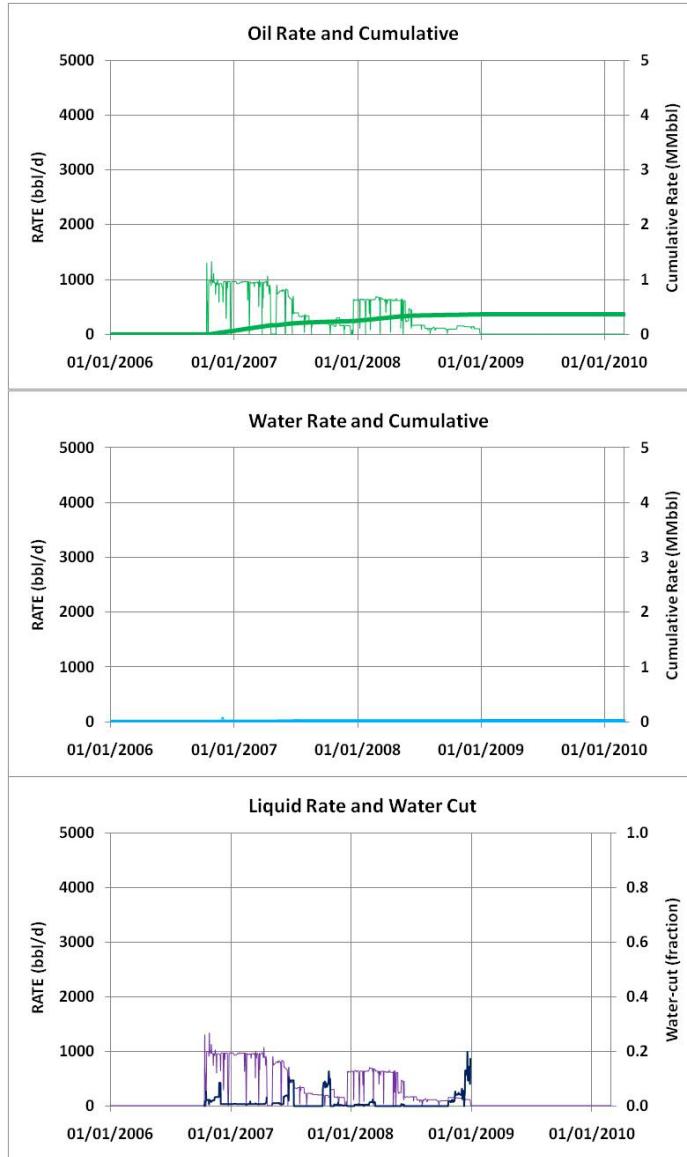


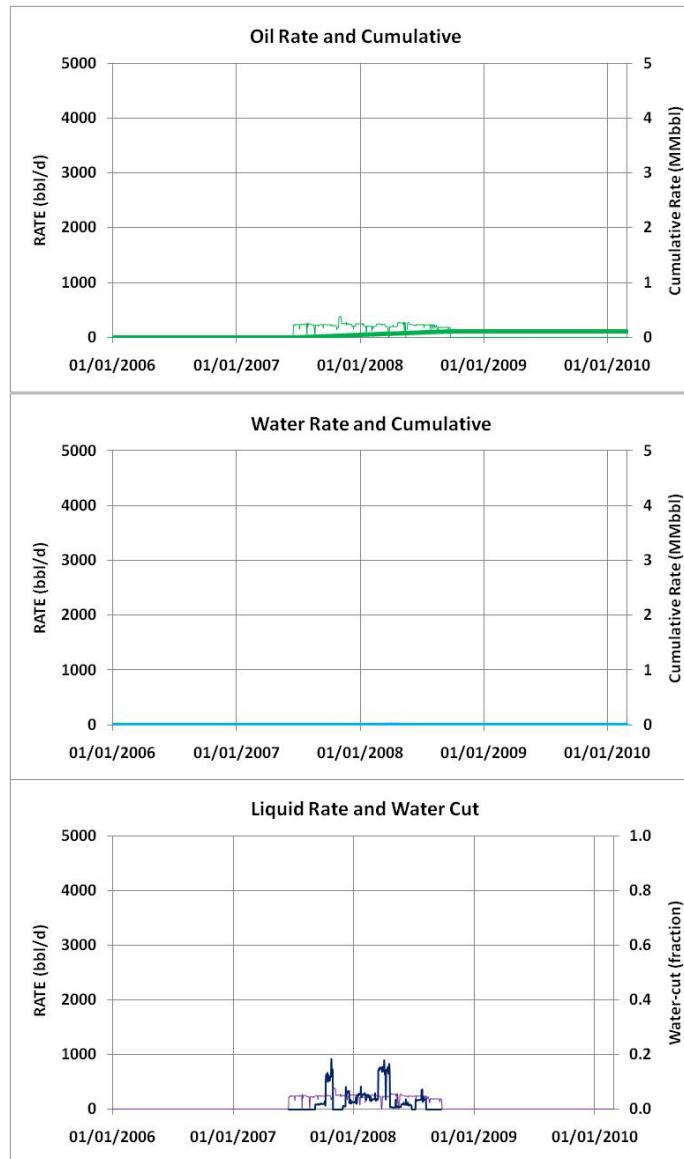
Production start

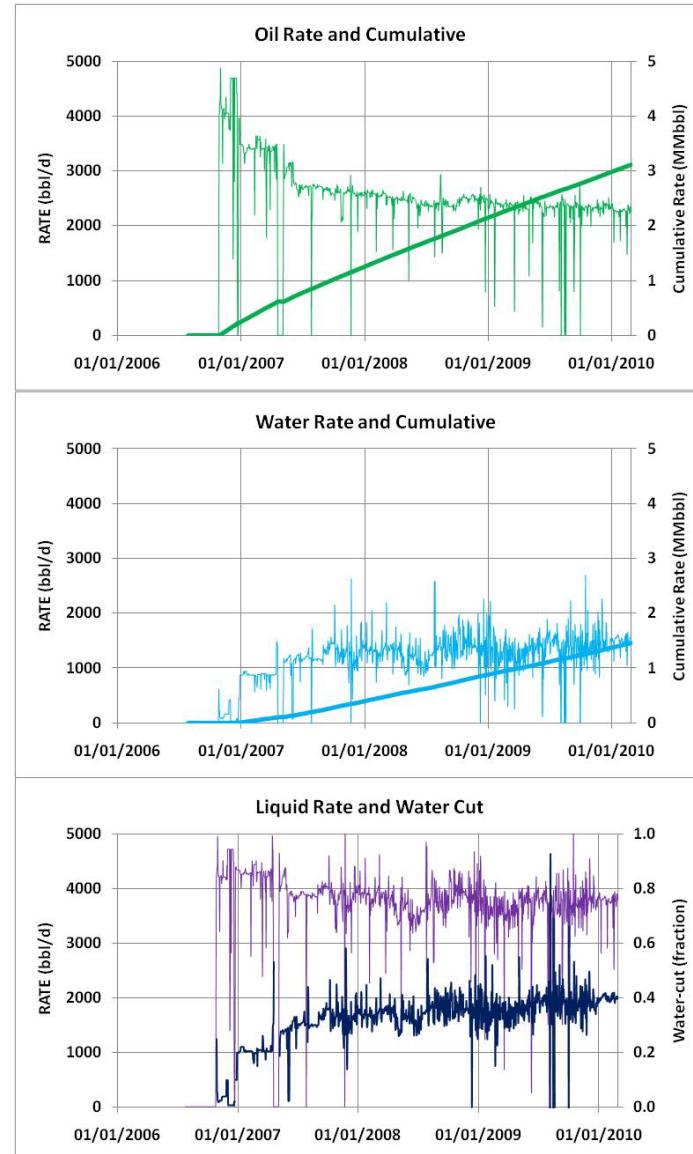
	Production start
B1	02/11/2006
B2	12/10/2006
B3	17/06/2007
B5H	27/10/2006
B6H	15/04/2007
B7H	25/06/2007
B9H	13/10/2007
B10H	01/06/2008
B11H	26/04/2008
B12H	14/08/2008
B13H	28/09/2008
B14H	07/01/2009
B15H	16/09/2009



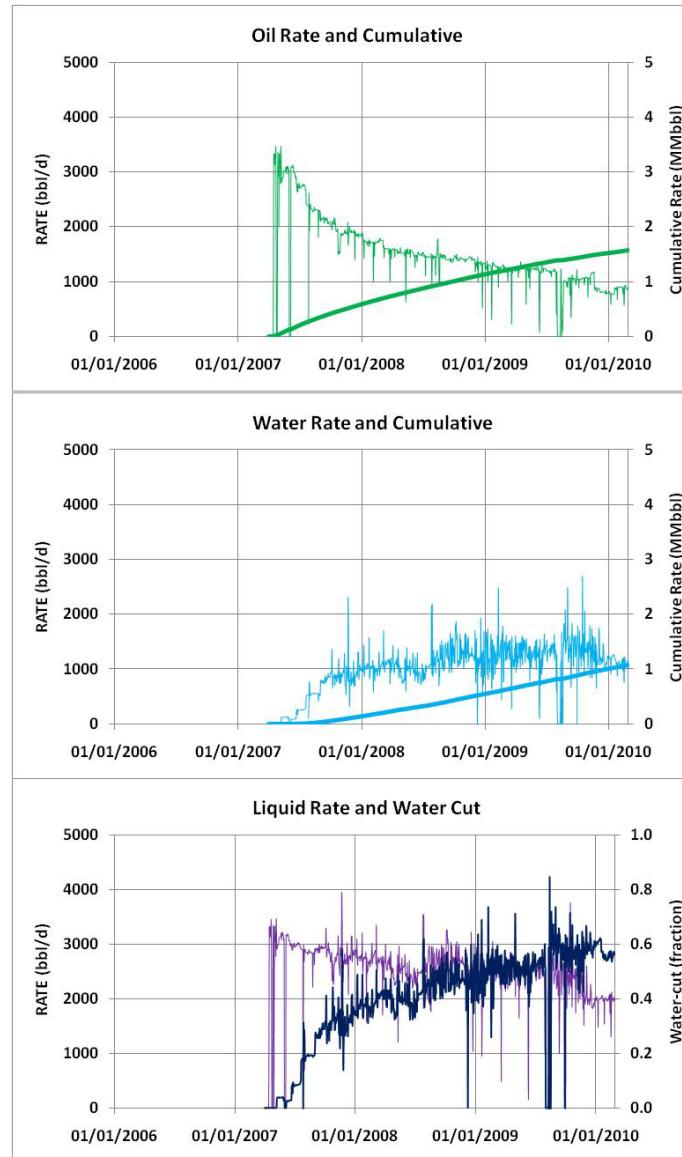
Production profiles of B1

**Production profiles of B2**

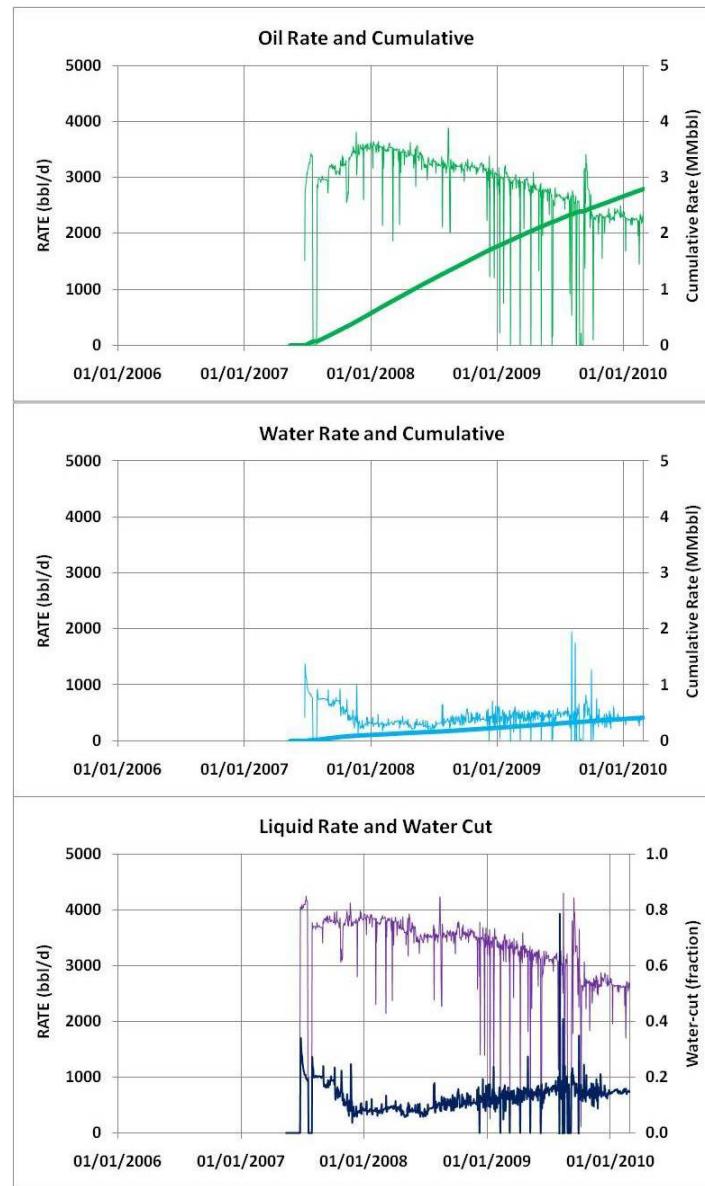
**Production profiles of B3**



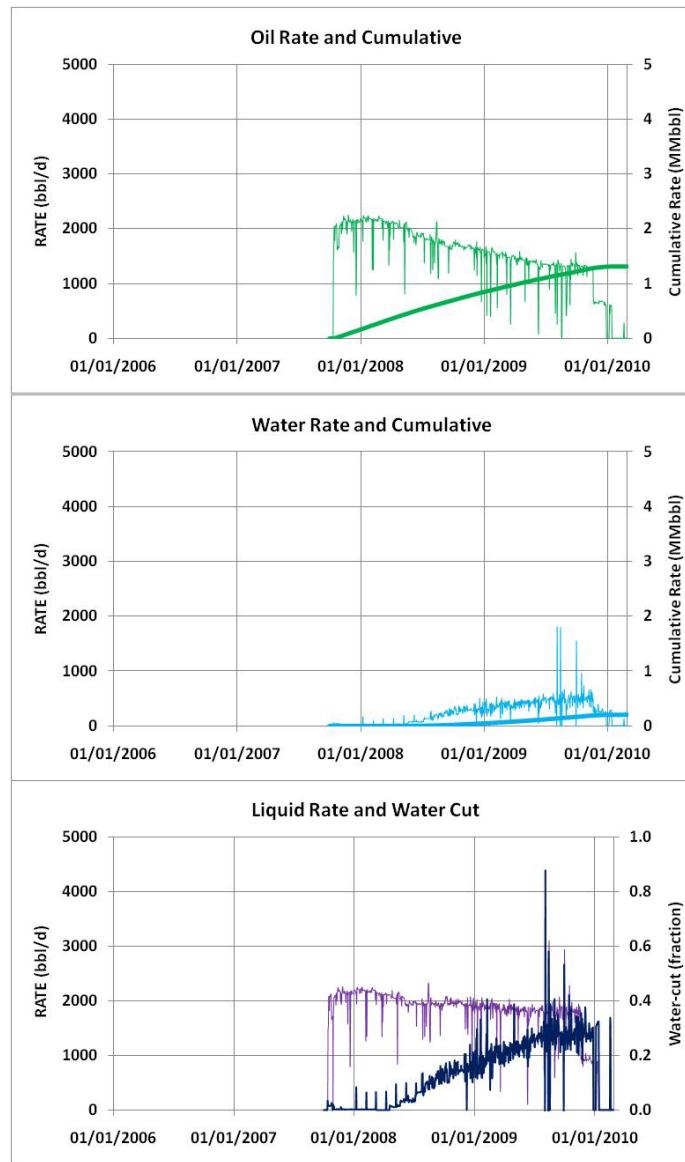
Production profiles of B5H

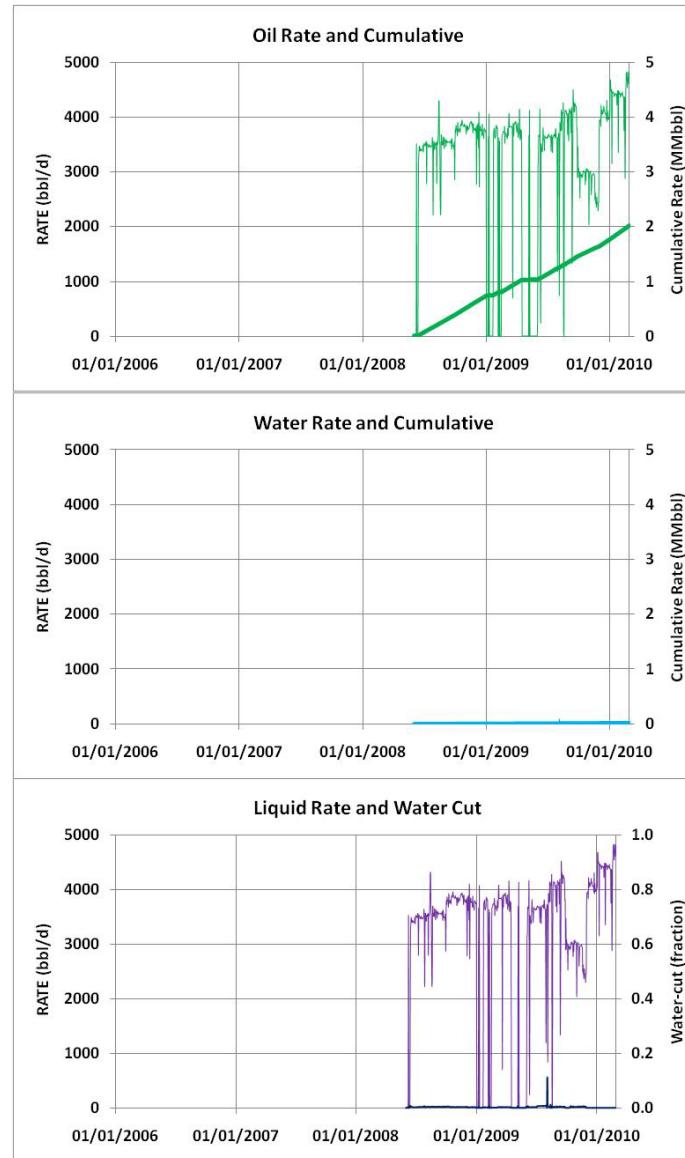


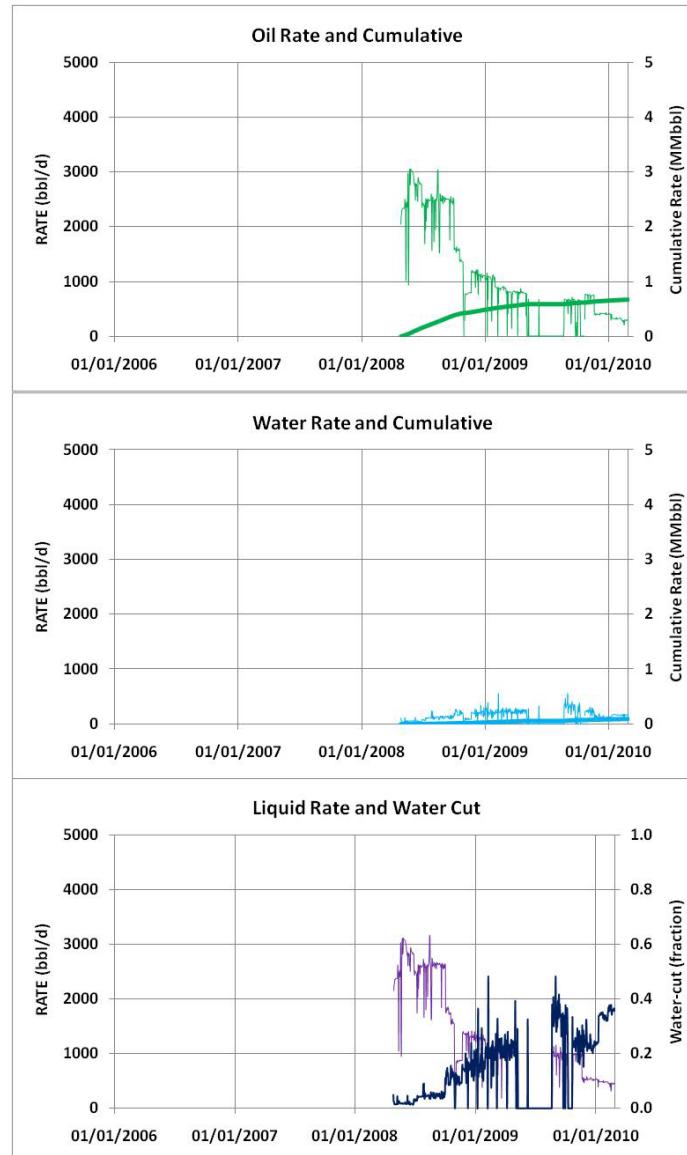
Production profiles of B6H



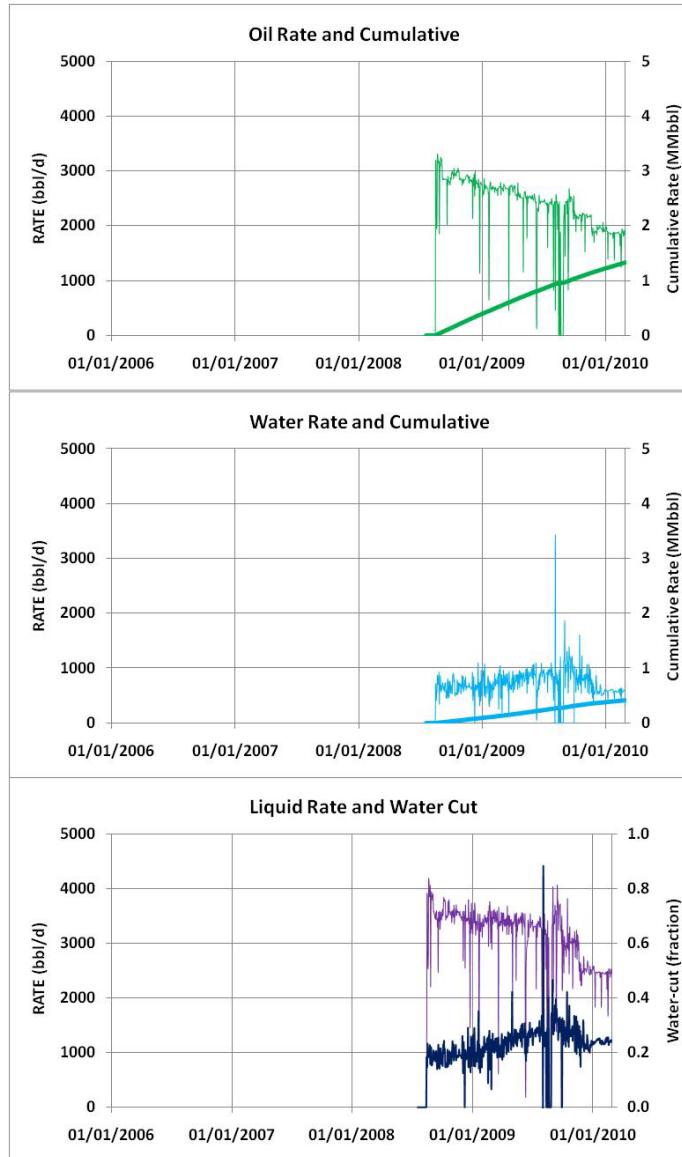
Production profiles of B7H

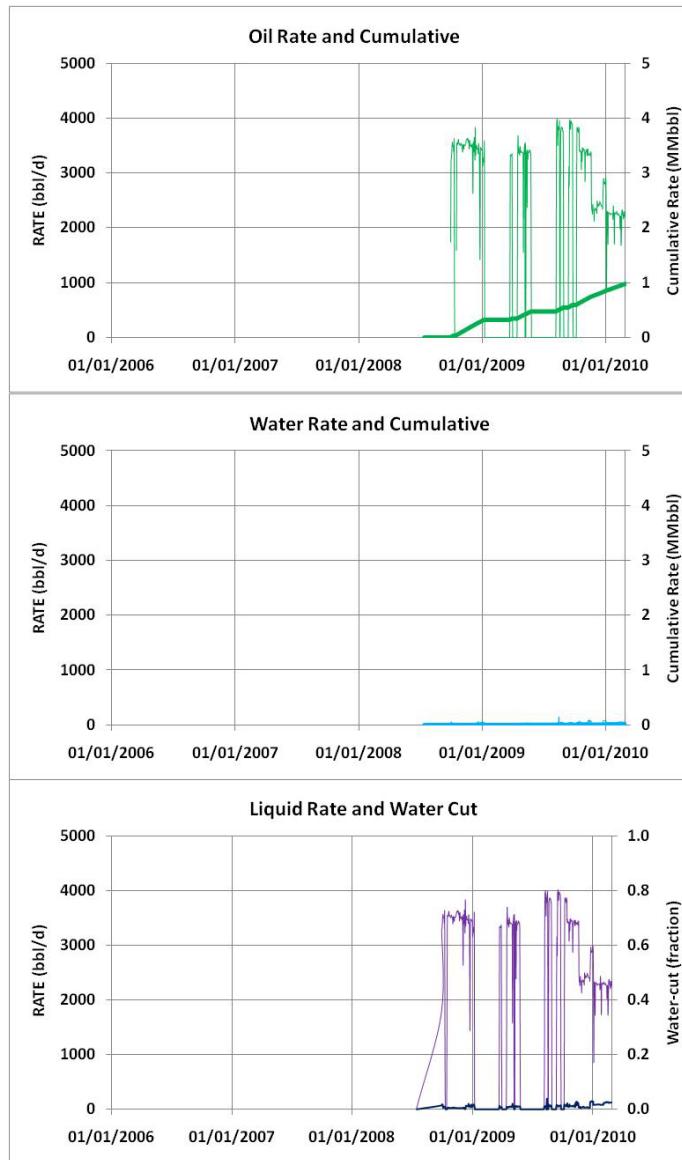
**Production profiles of B9H**

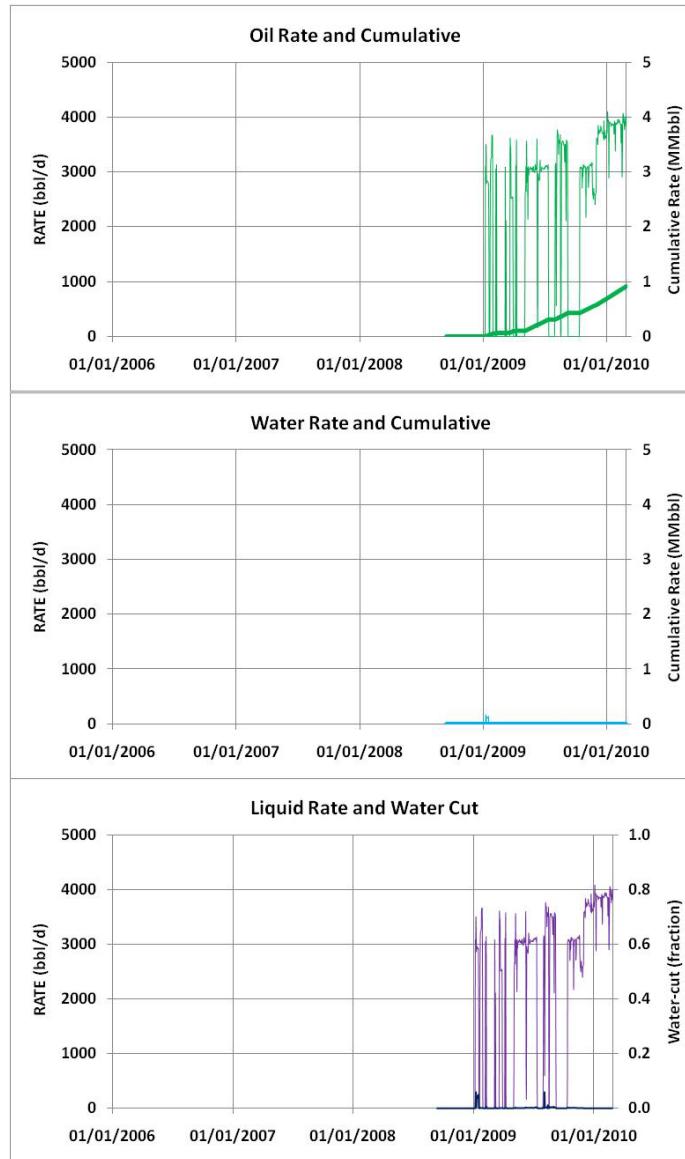
**Production profiles of B10H**

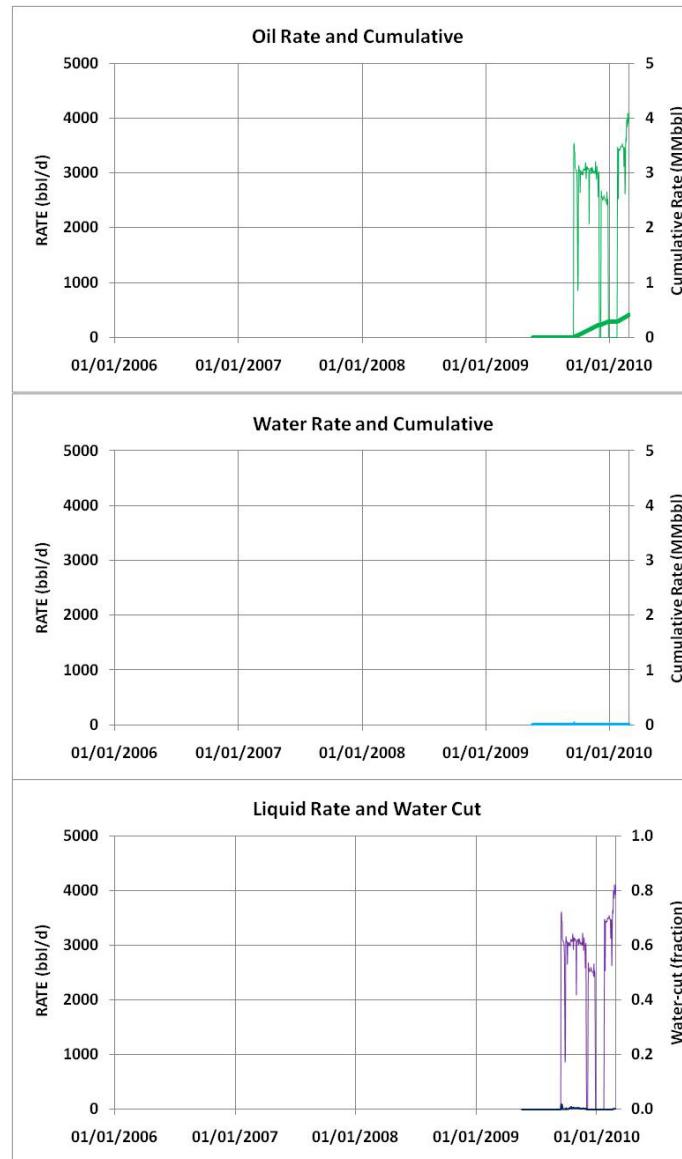


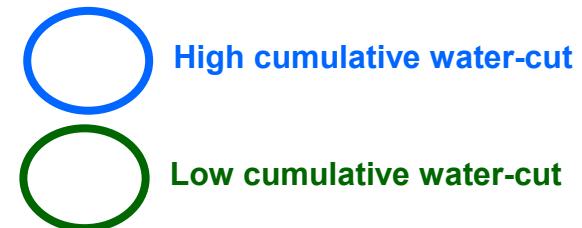
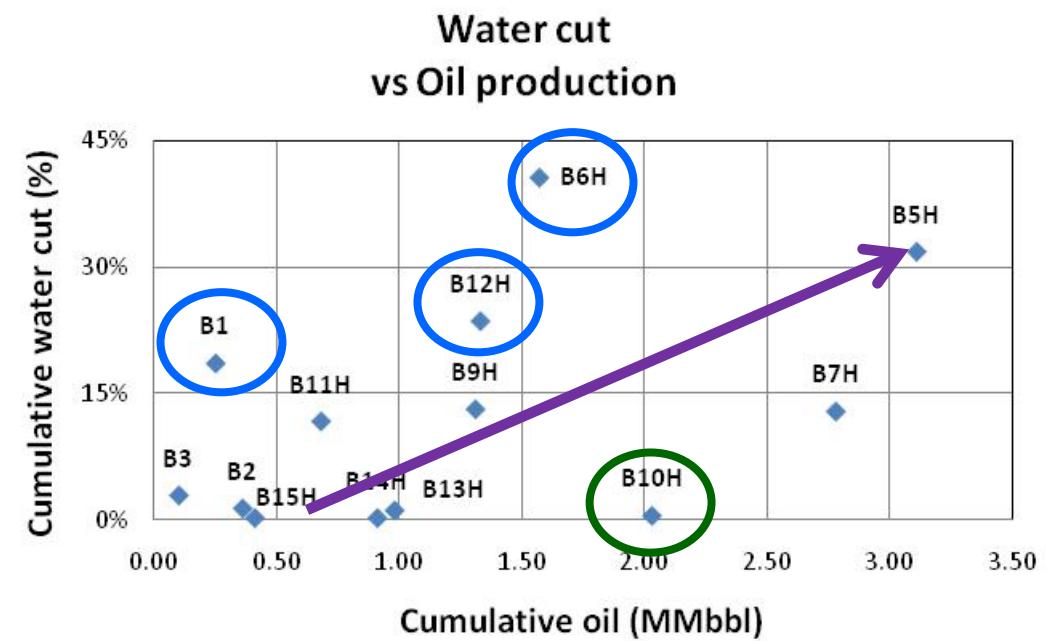
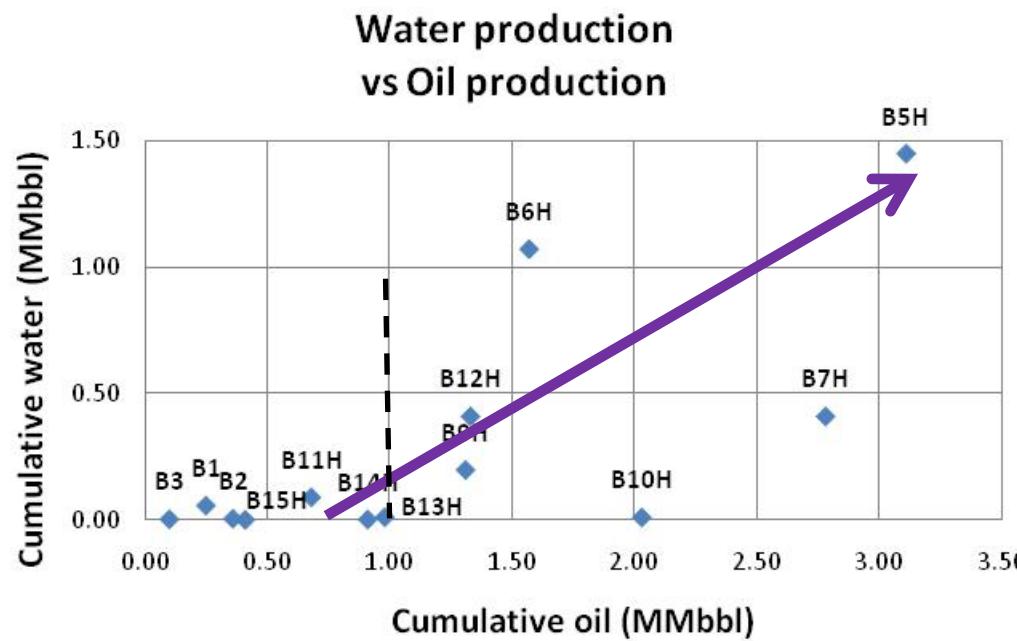
Production profiles of B11H

**Production profiles of B12H**

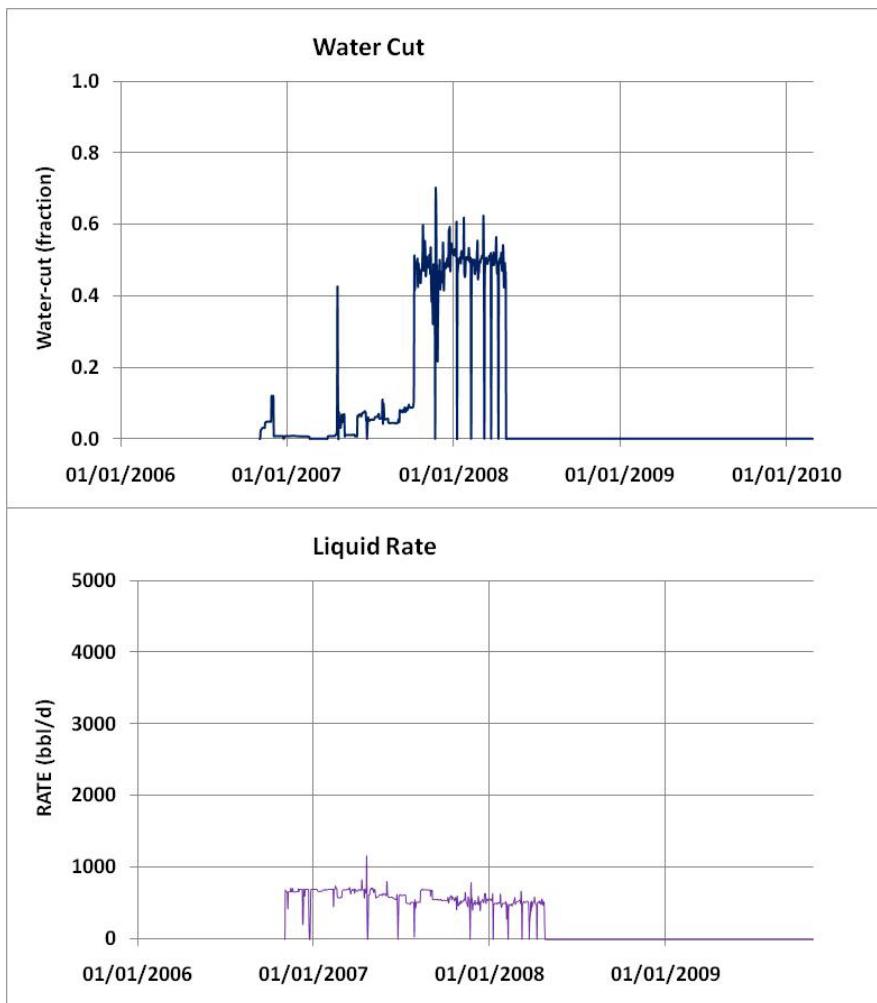
**Production profiles of B13H**

**Production profiles of B14H**

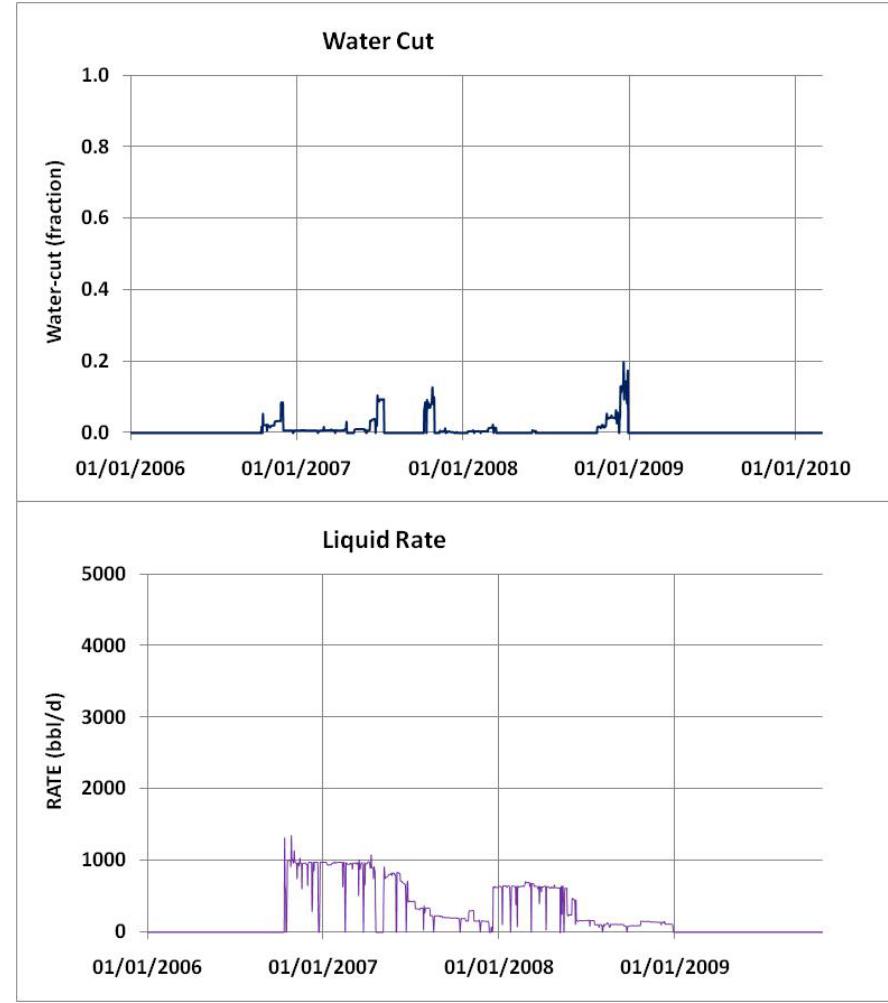
**Production profiles of B15H**

**Relationships between water and oil production**

B1

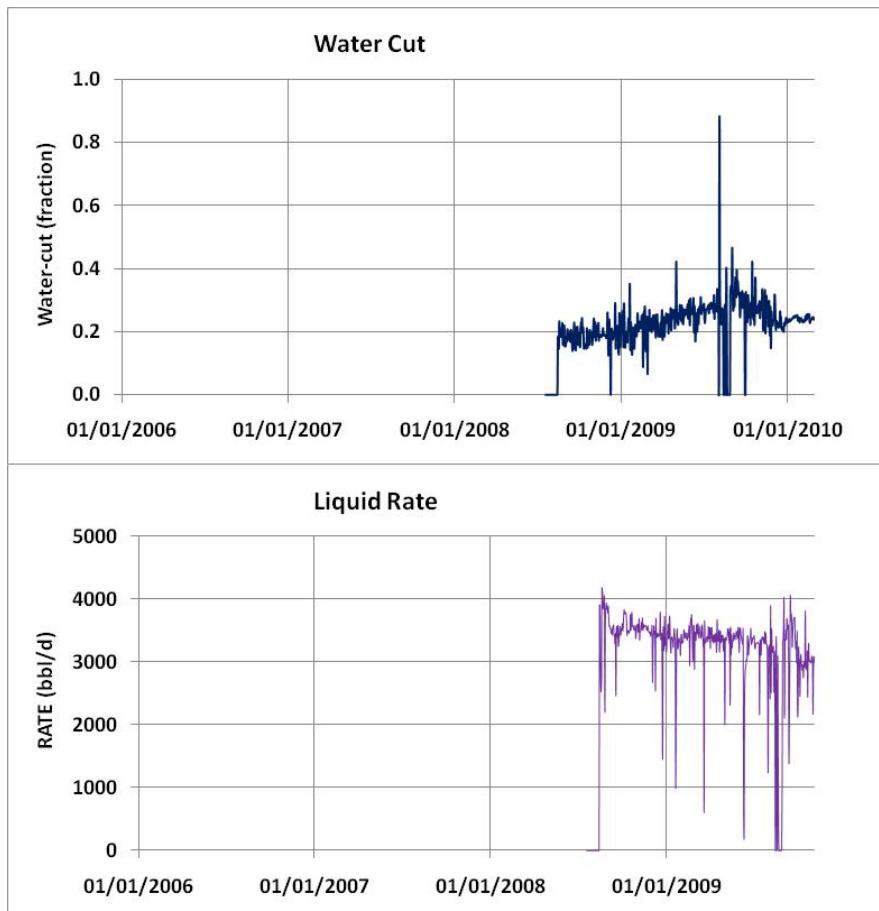


B2

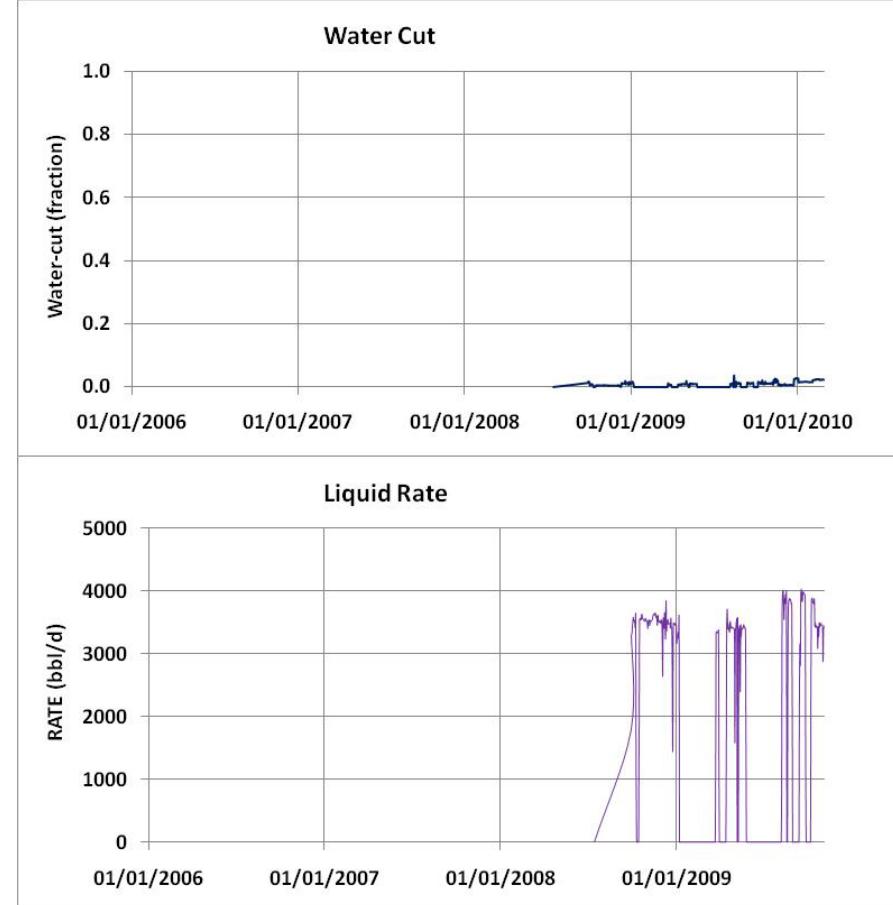


Liquid rate and water cut data in B1 and B2

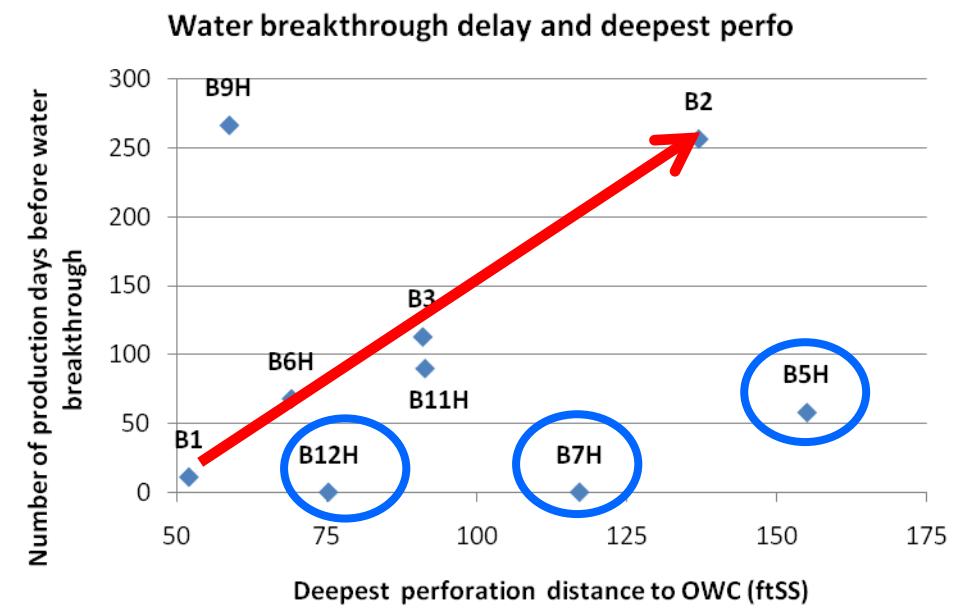
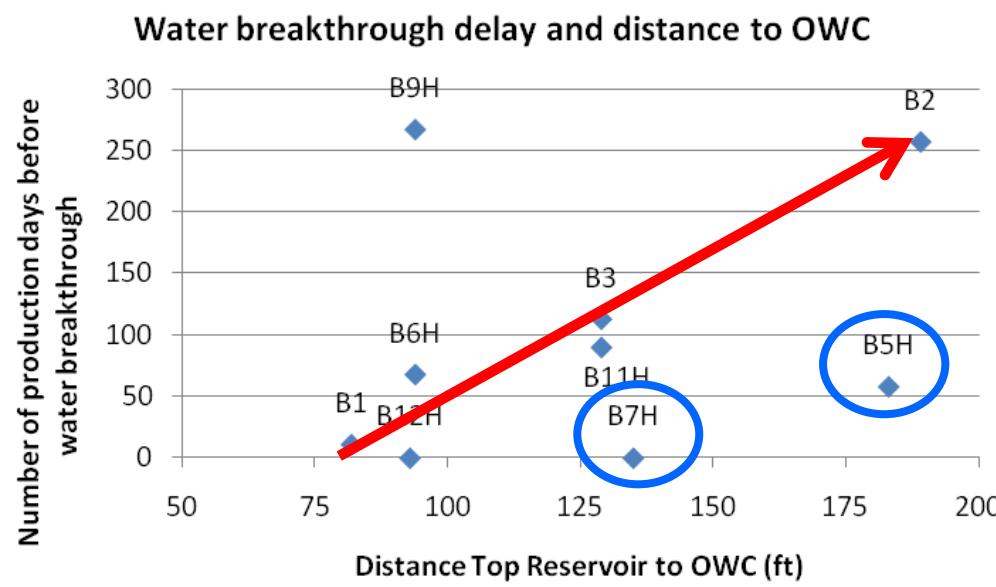
B12H



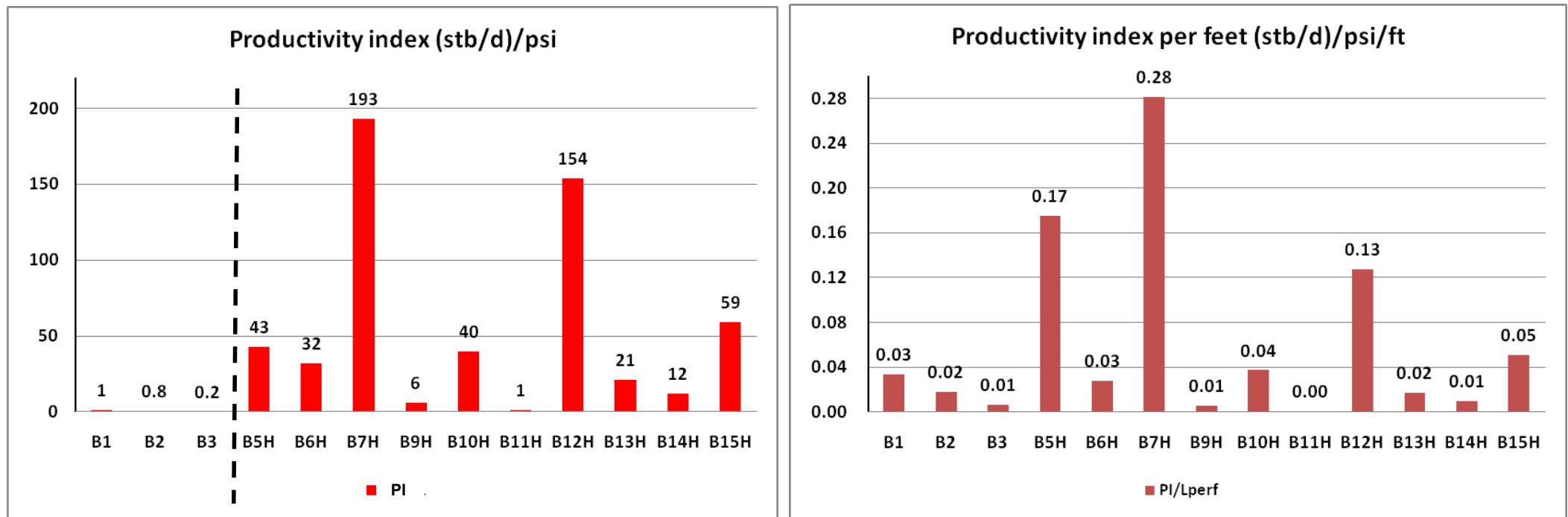
B13H



Liquid rate and water cut data in B12H and B13H



Early water breakthrough



a)

b)

Productivity index per well

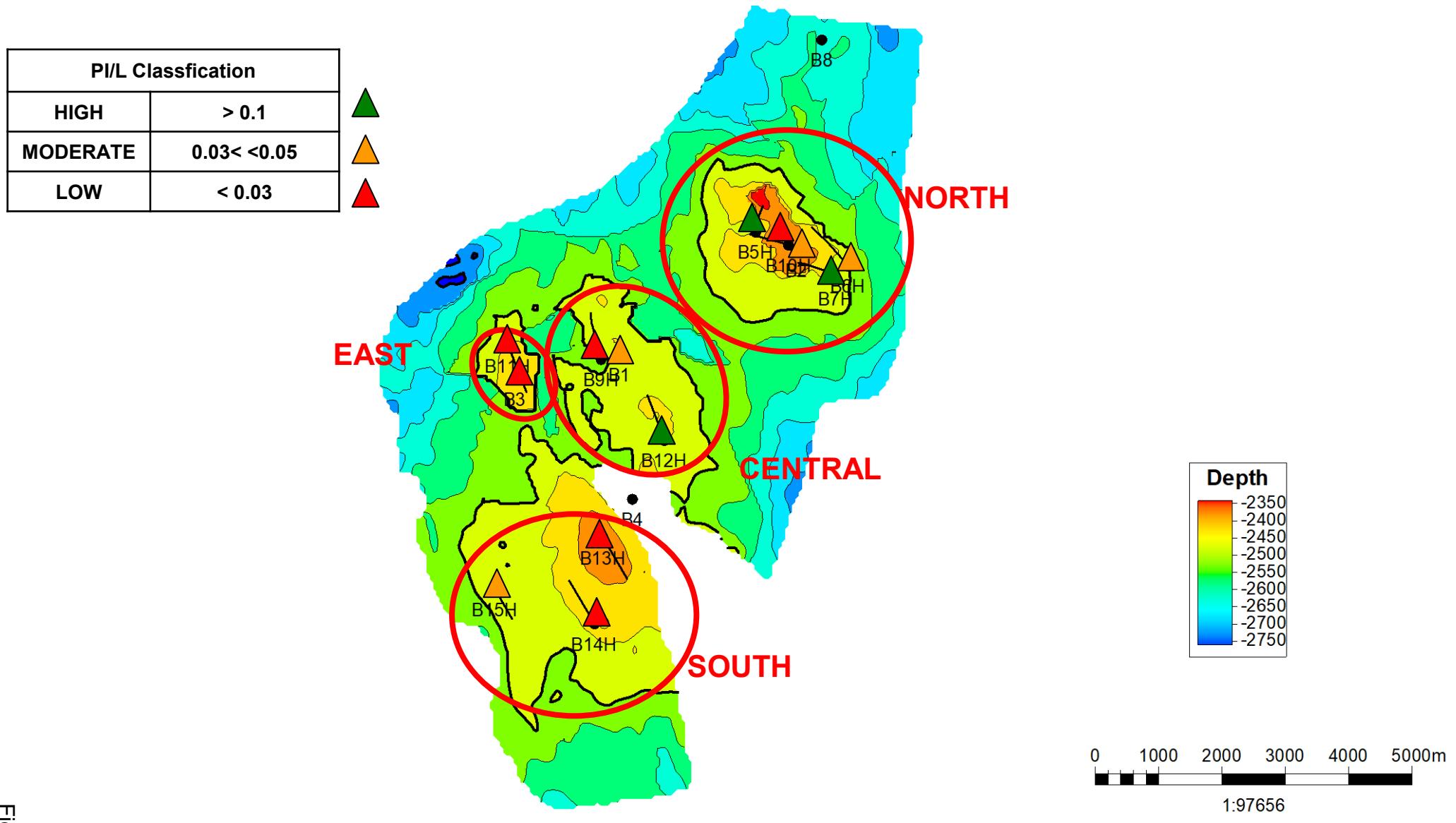
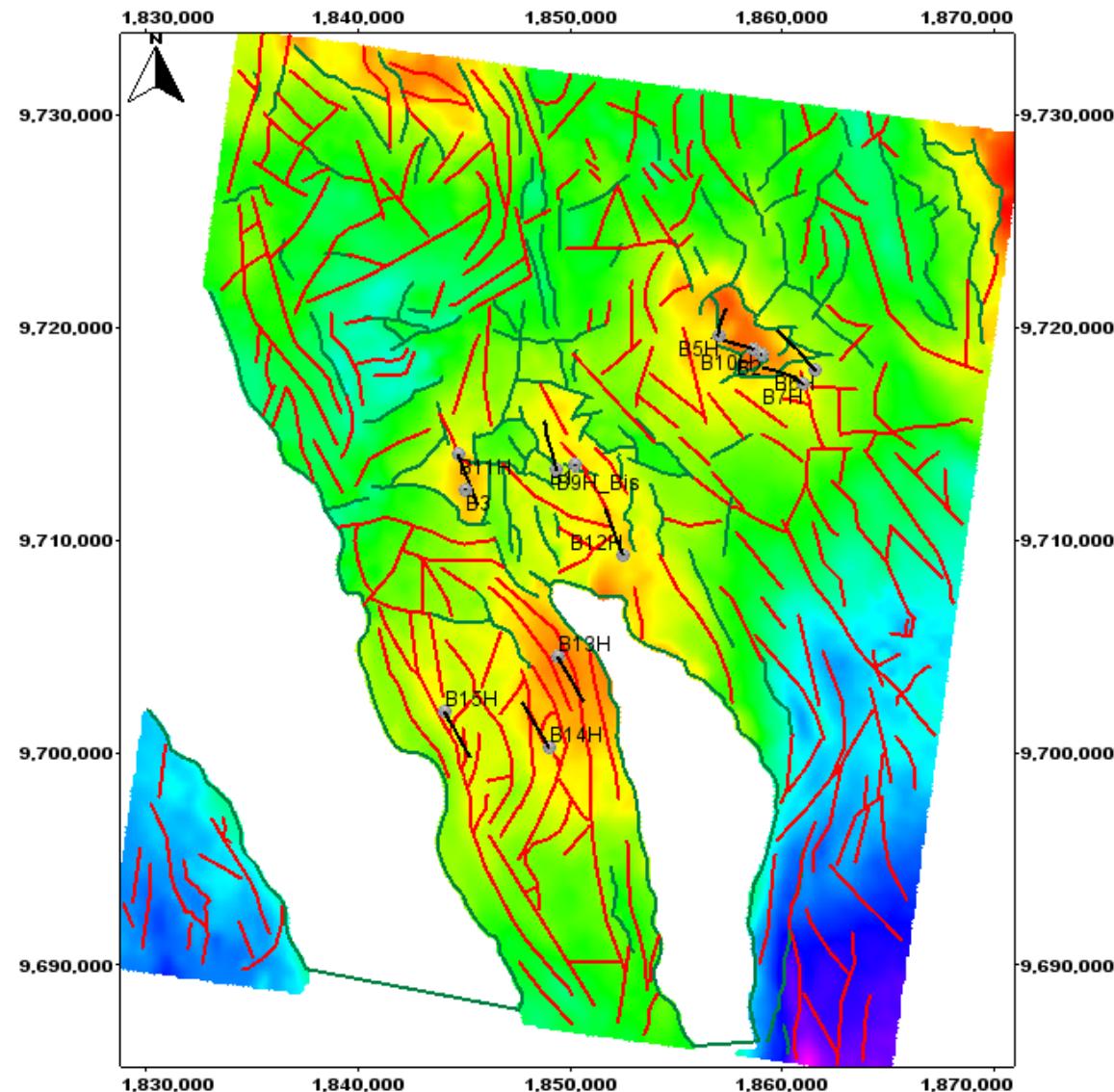


Fig. 5.24

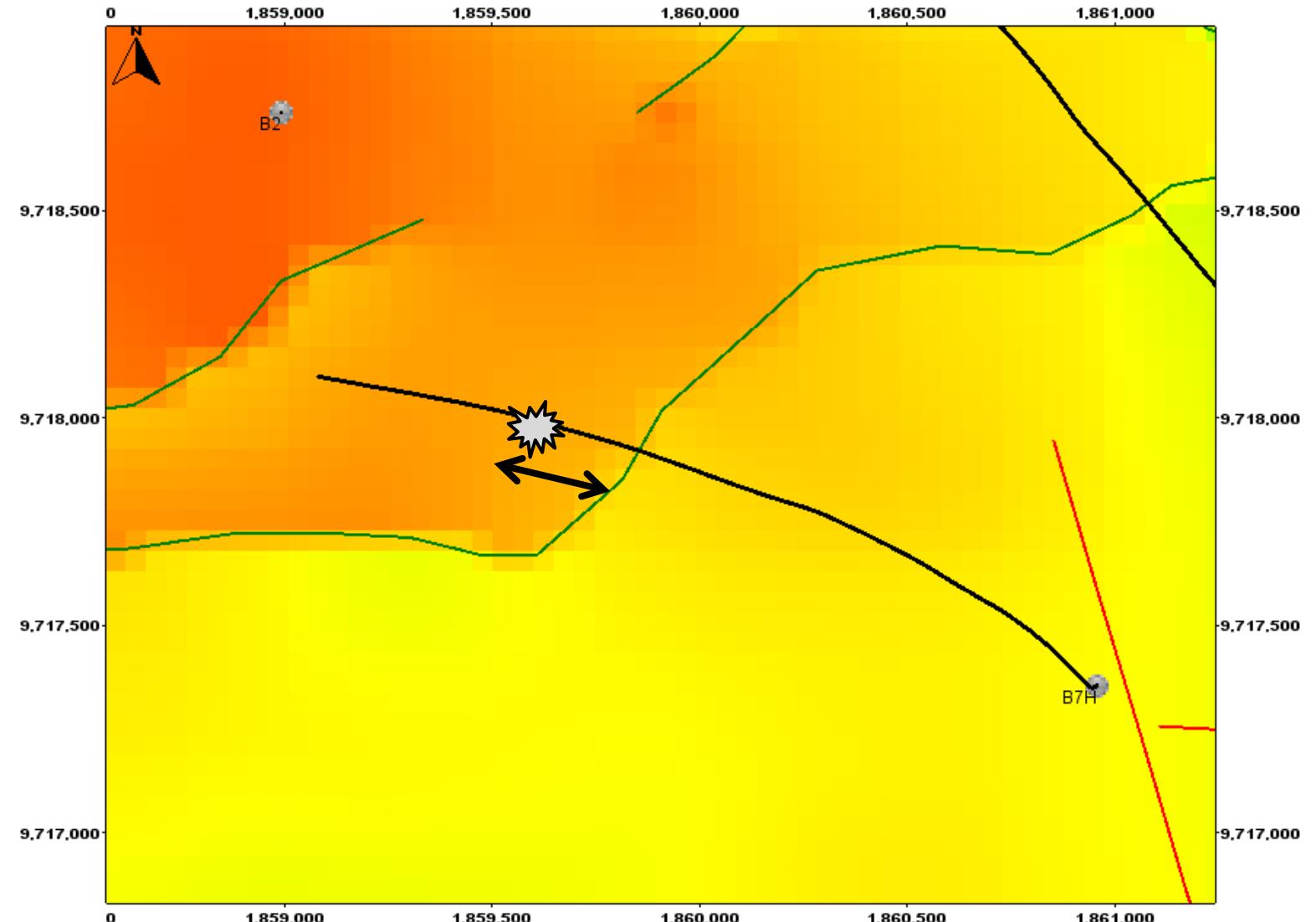
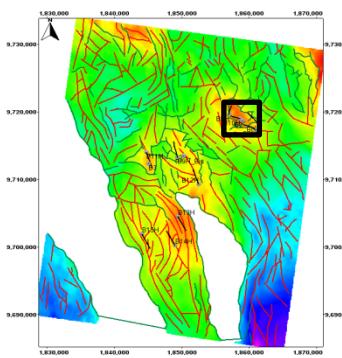
Top Mamuniyat



FAULTS
LINEAMENTS

Fig. 5.25

Structural objects obtained from seismic analyses in the B-NC186 field



Well entry in
the reservoir

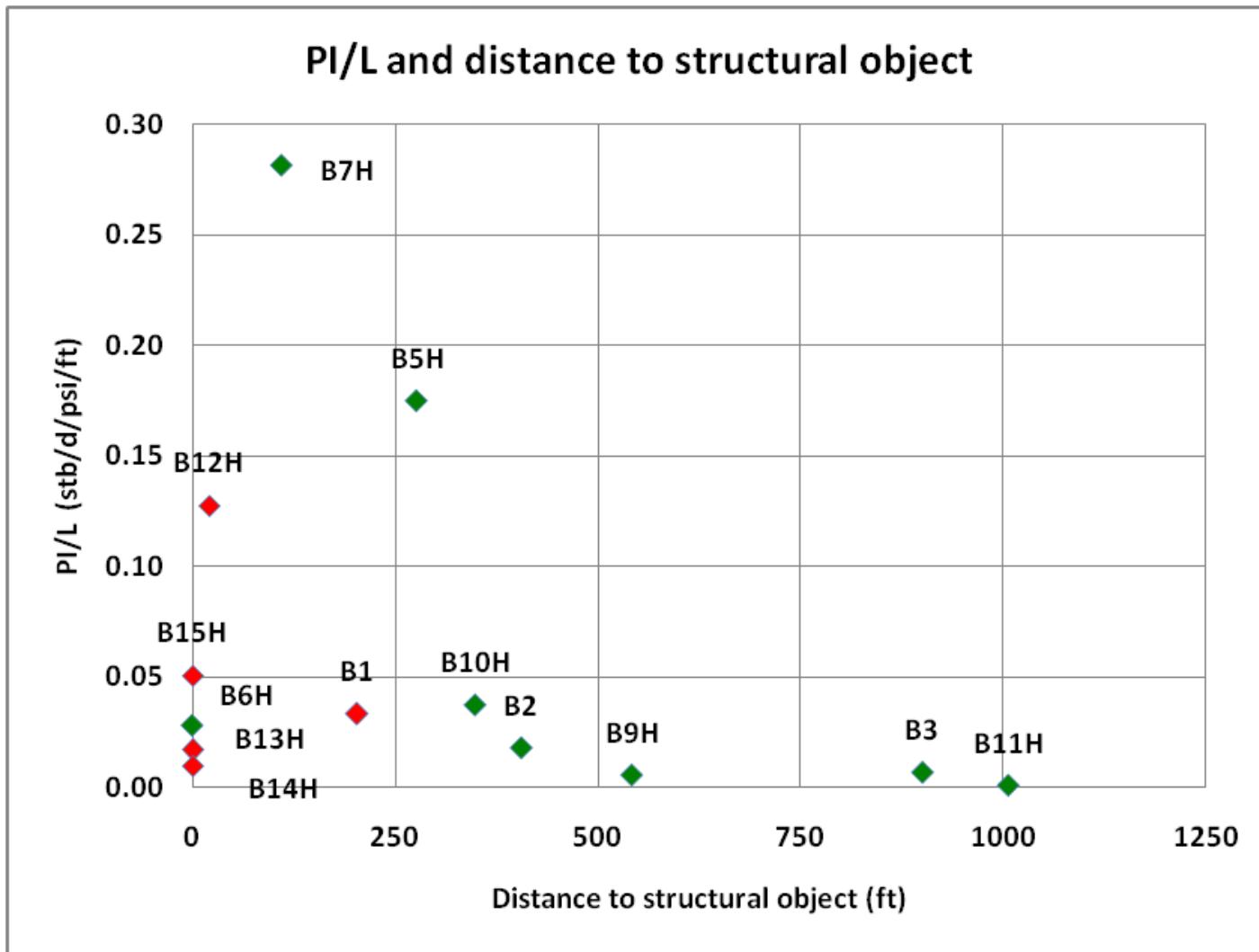
↔ Distance to
structural
object

FAULTS

LINEAMENTS

Fig. 5.26

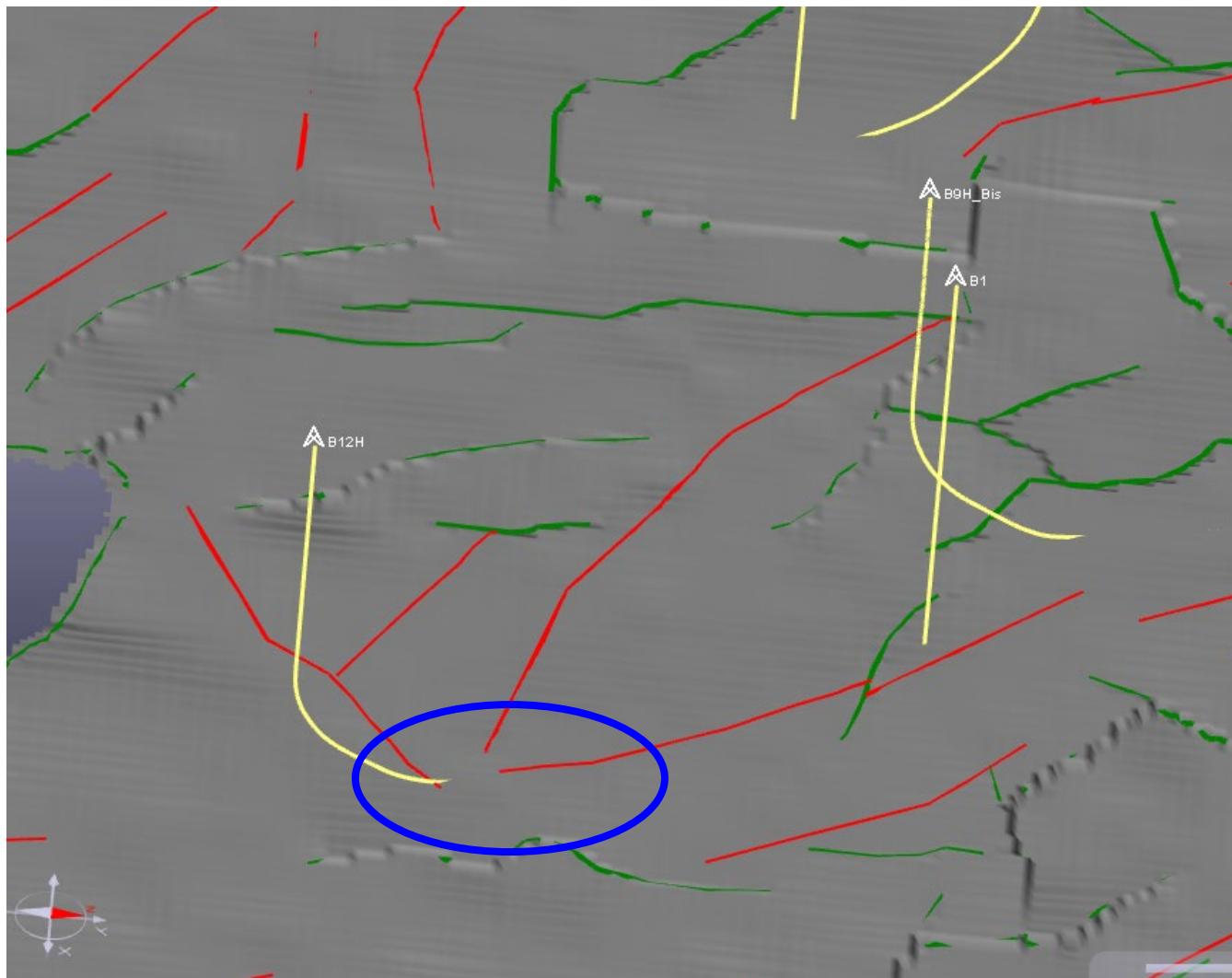
Example of determination of the distance between a well and the nearest structural object



FAULTS
LINEAMENTS

Productivity index and distance to structural objects

Top Mamuniyat



FAULTS
LINEAMENTS

Lineaments near B12H

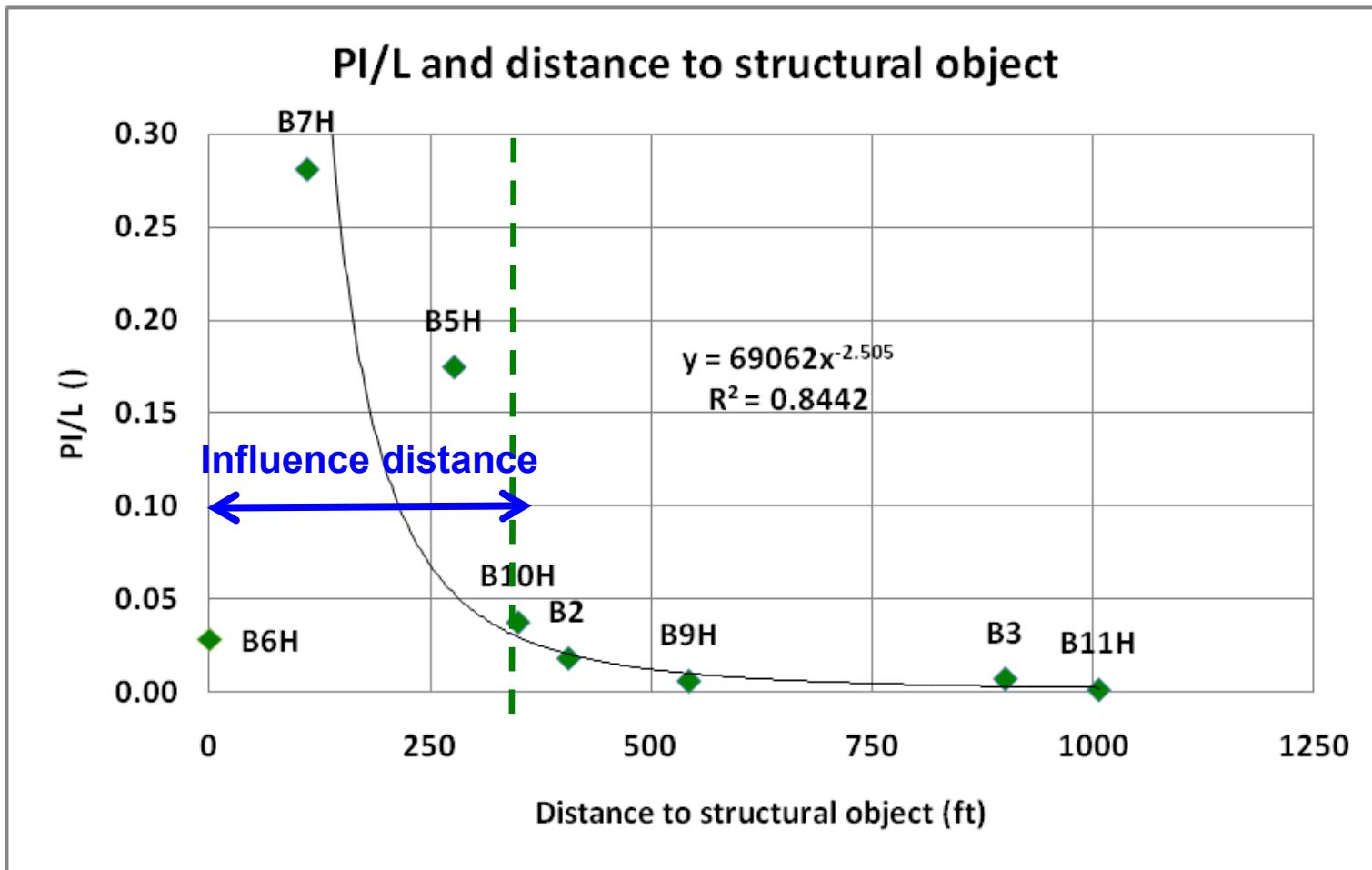
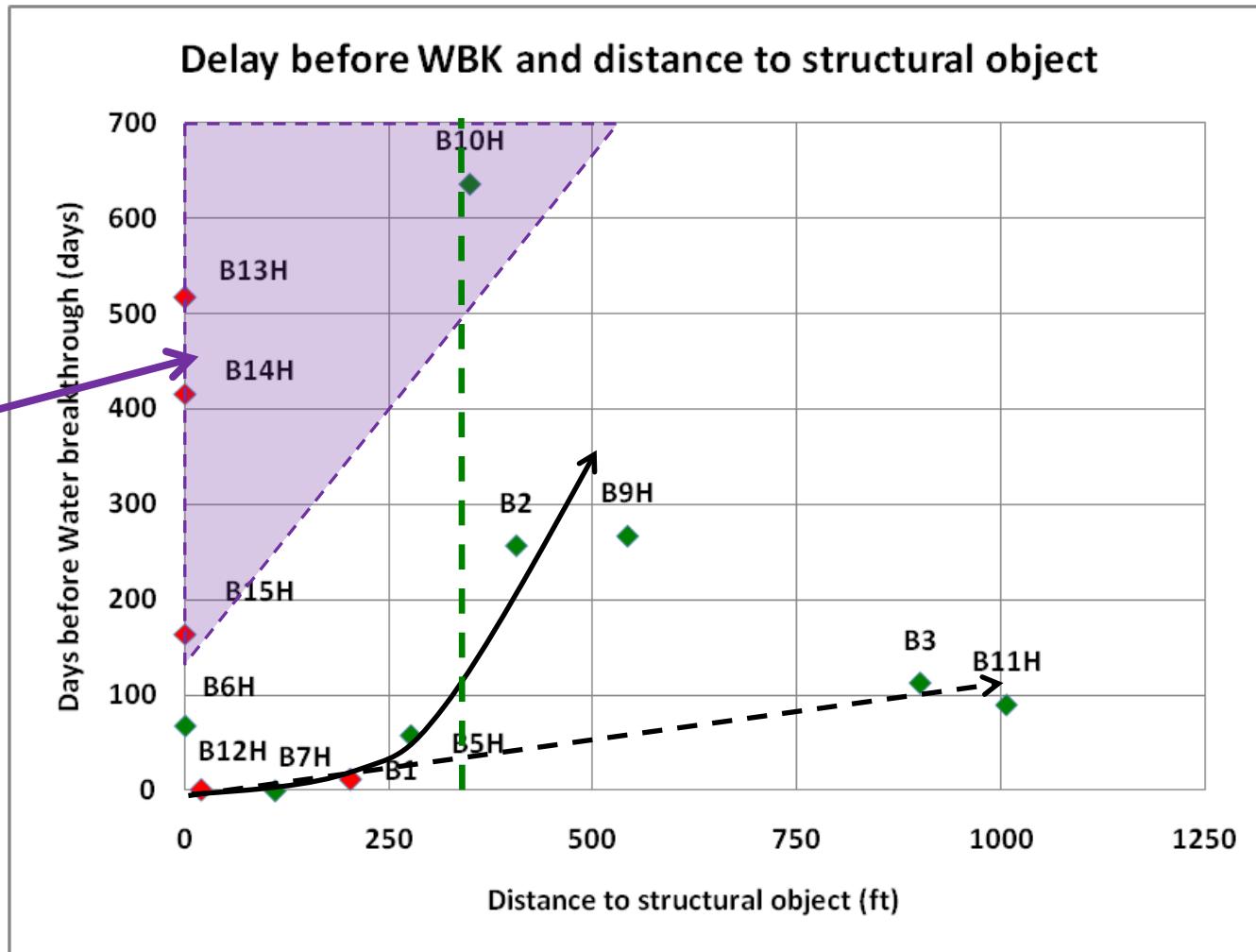


Fig. 5.29

Productivity index and distance to faults

Wells without WBK
@28/02/2010



FAULTS
LINEAMENTS

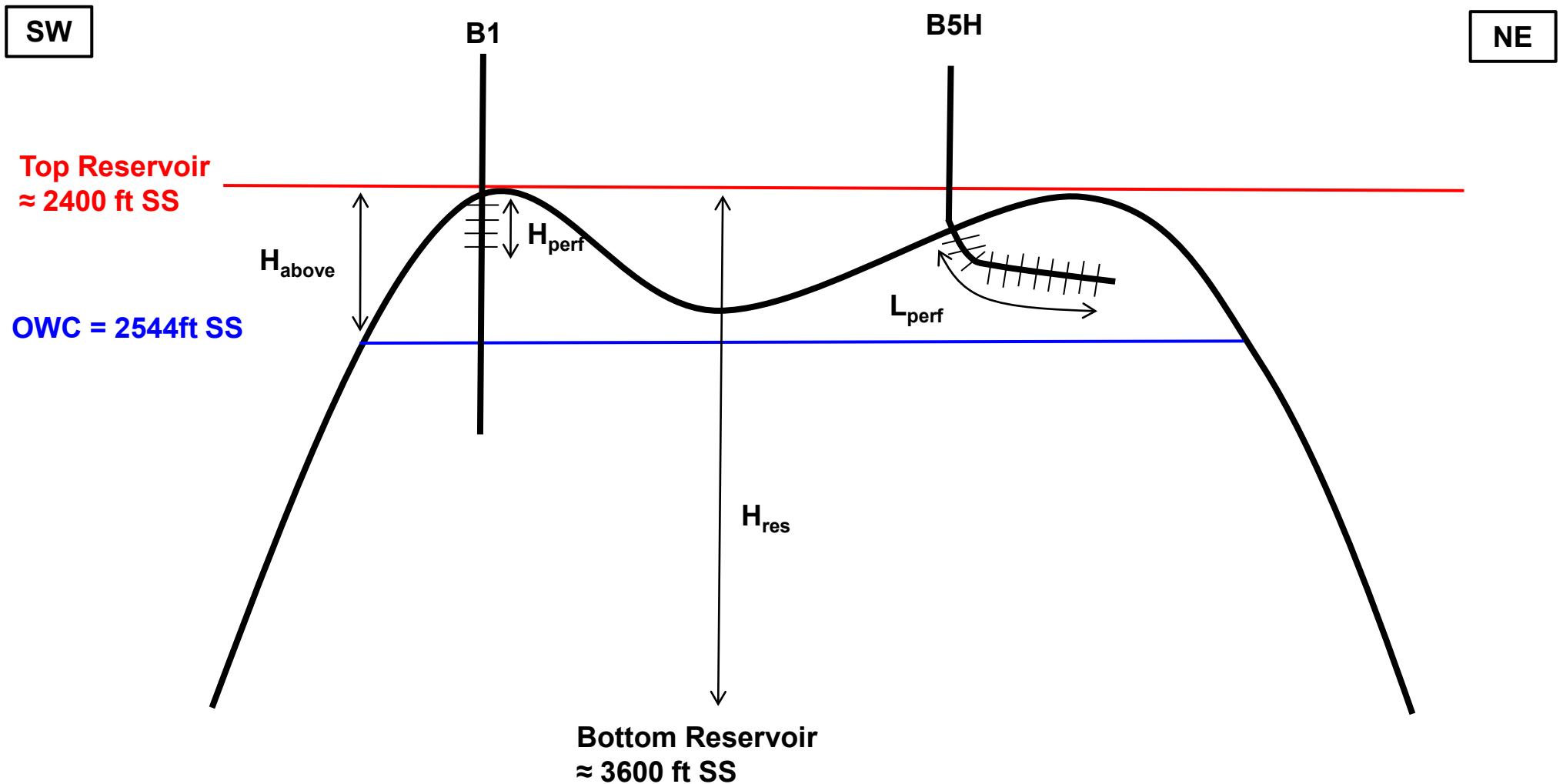


Fig. 5.31

Synthetic cross-section of B-NC186 field

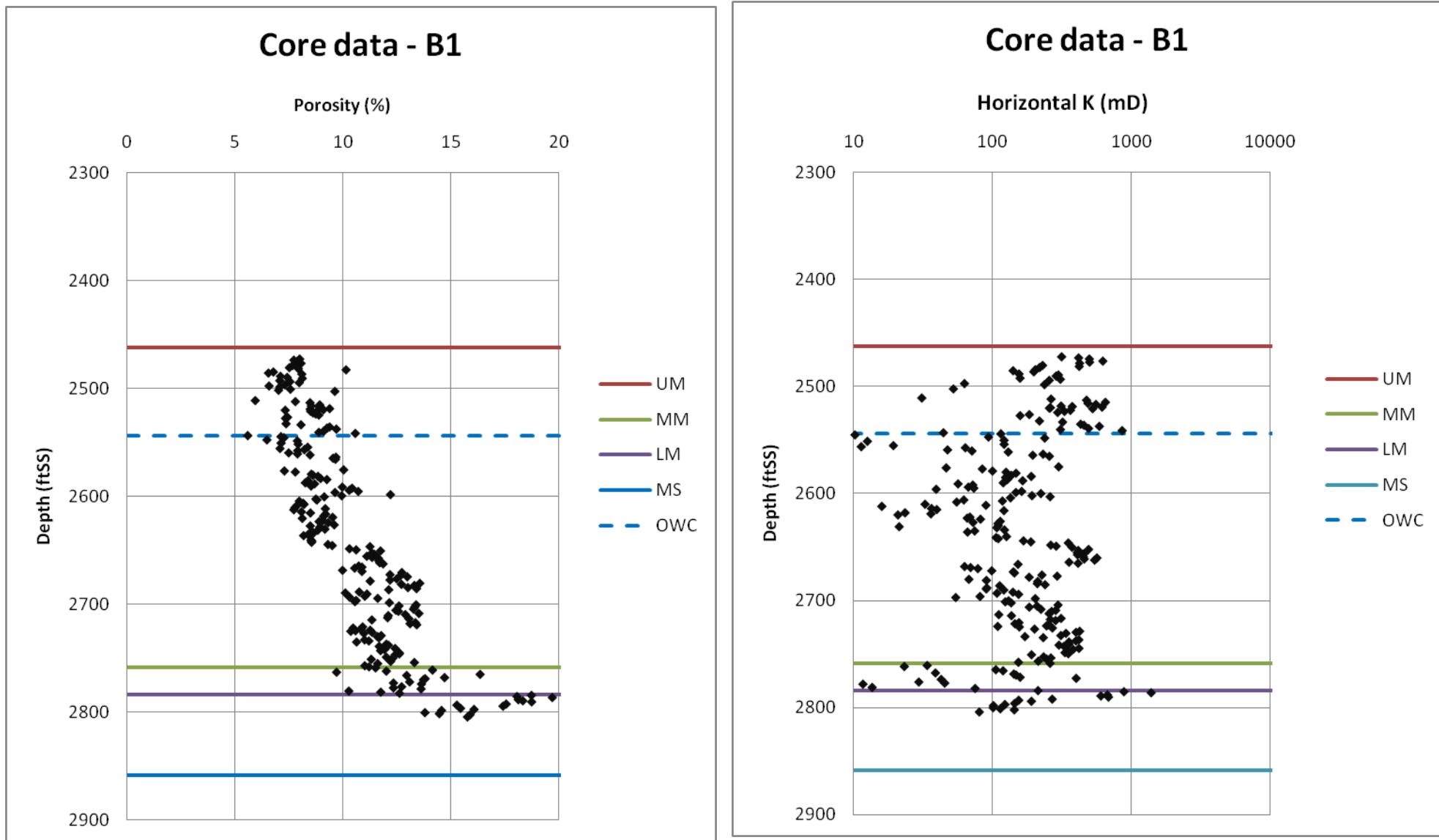
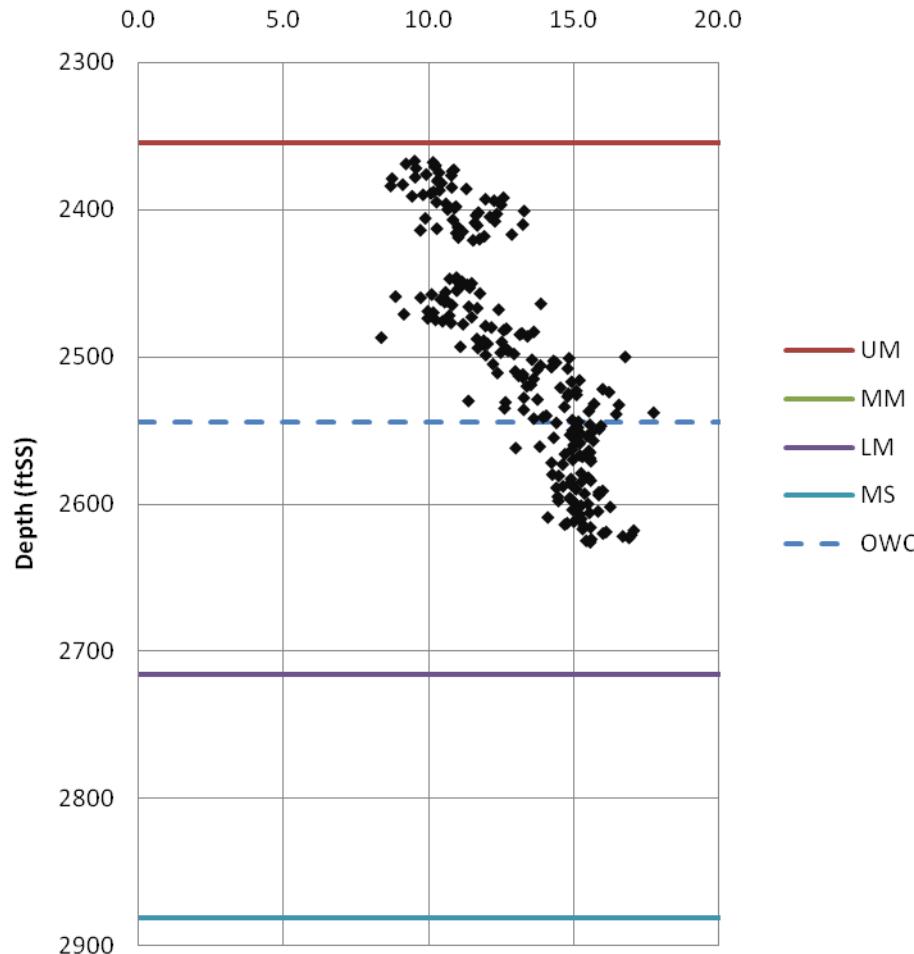


Fig. 5.32

B1 – Porosity and Permeability core measurements

Core data - B2

Porosity (%)

**Core data - B2**

Horizontal K (mD)

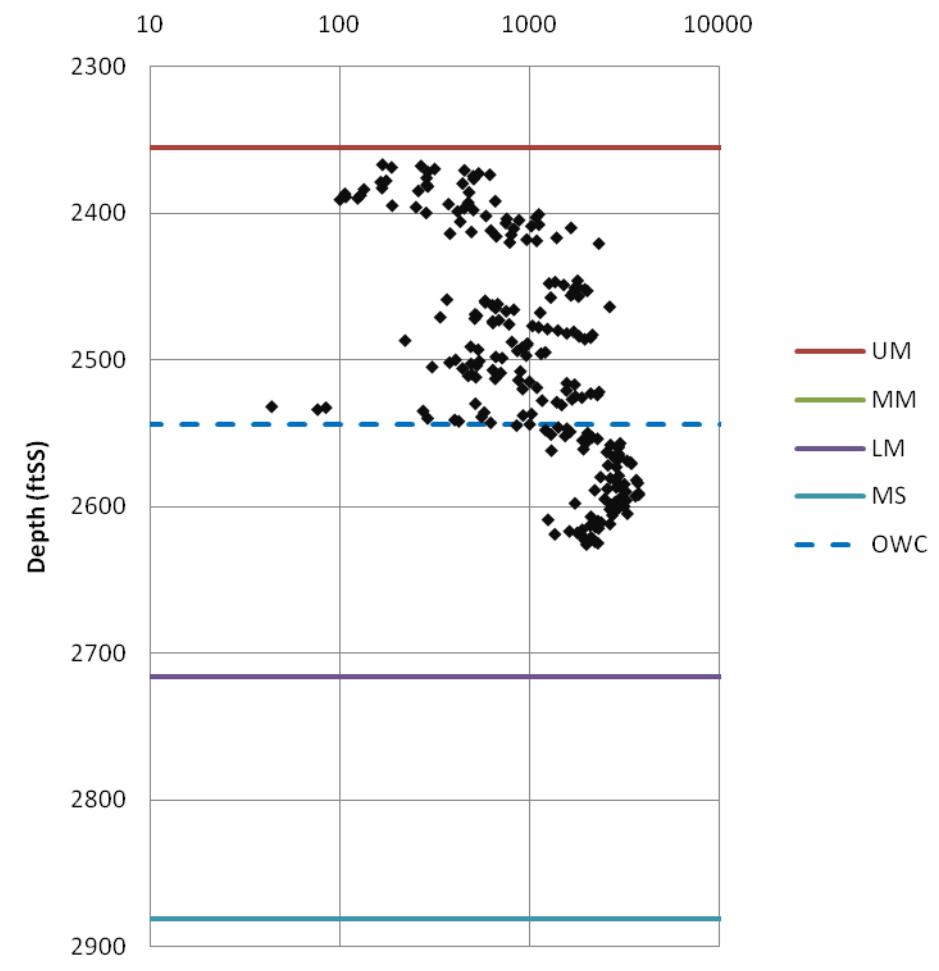
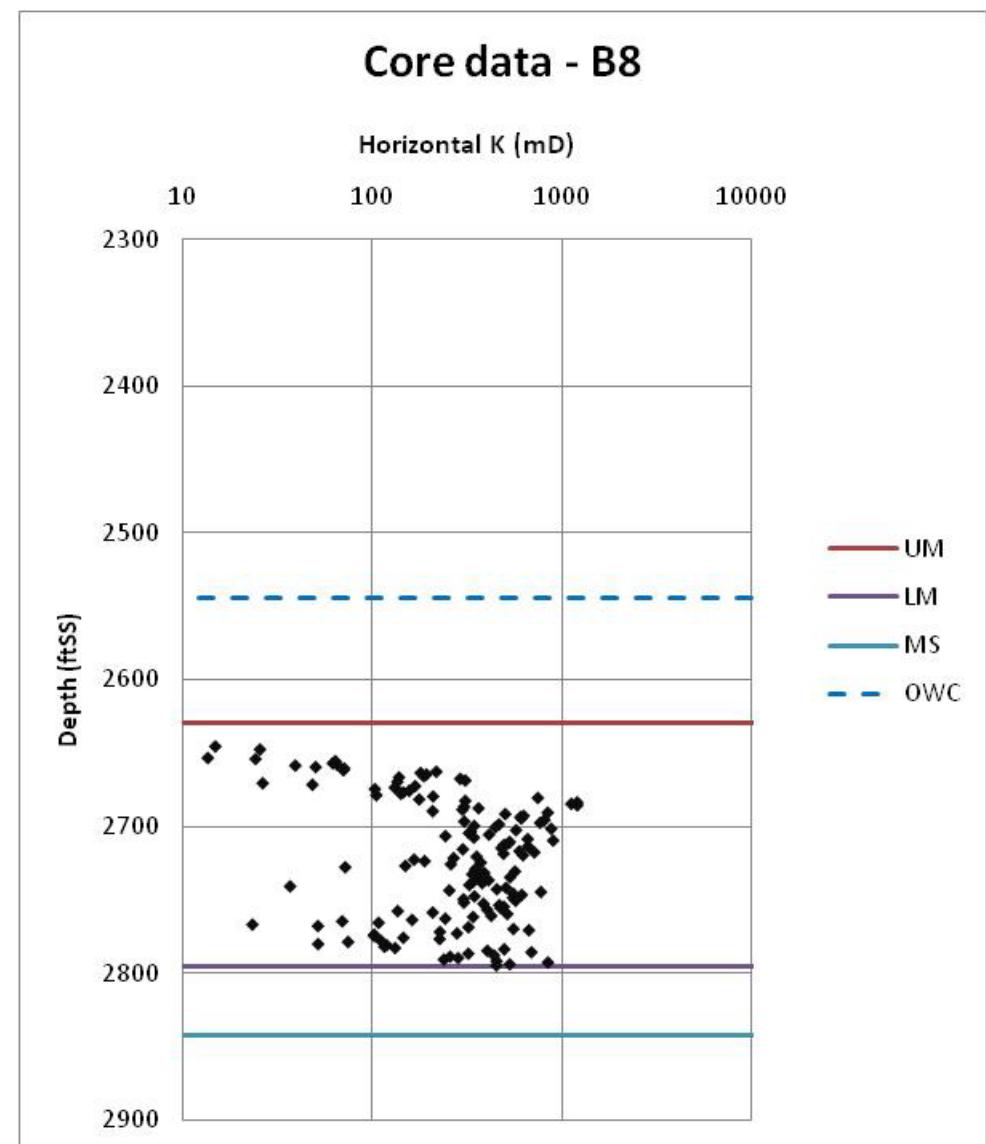
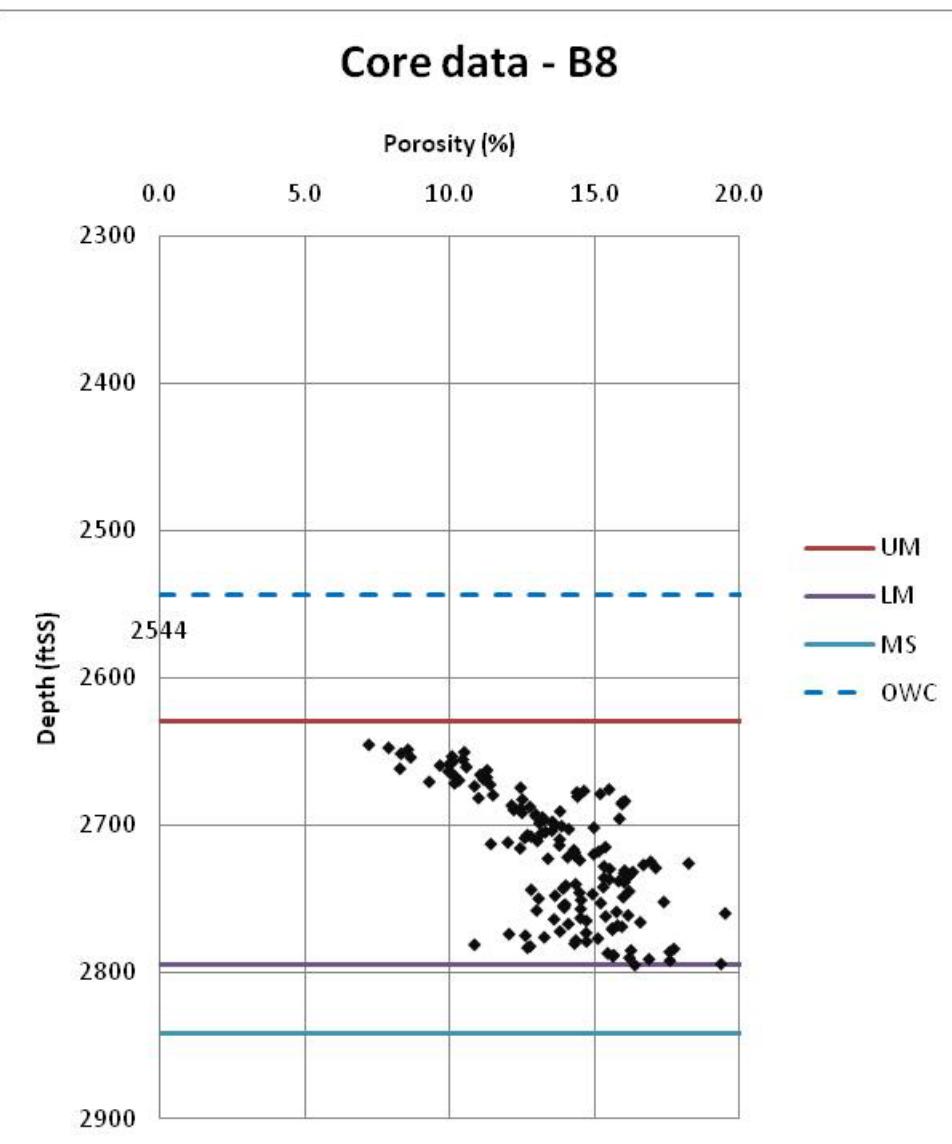


Fig. 5.33

B2 – Porosity and Permeability core measurements



B8 – Porosity and Permeability core measurements

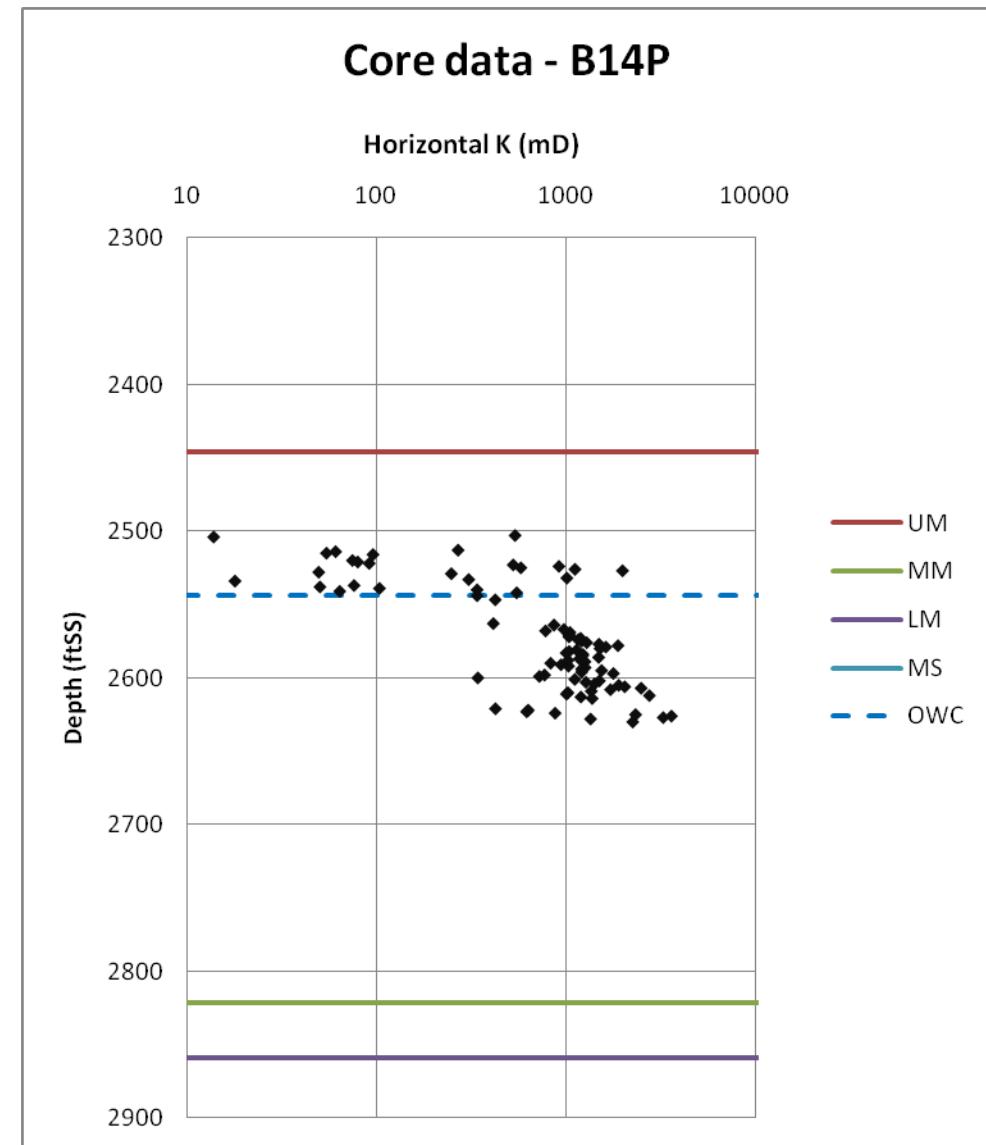
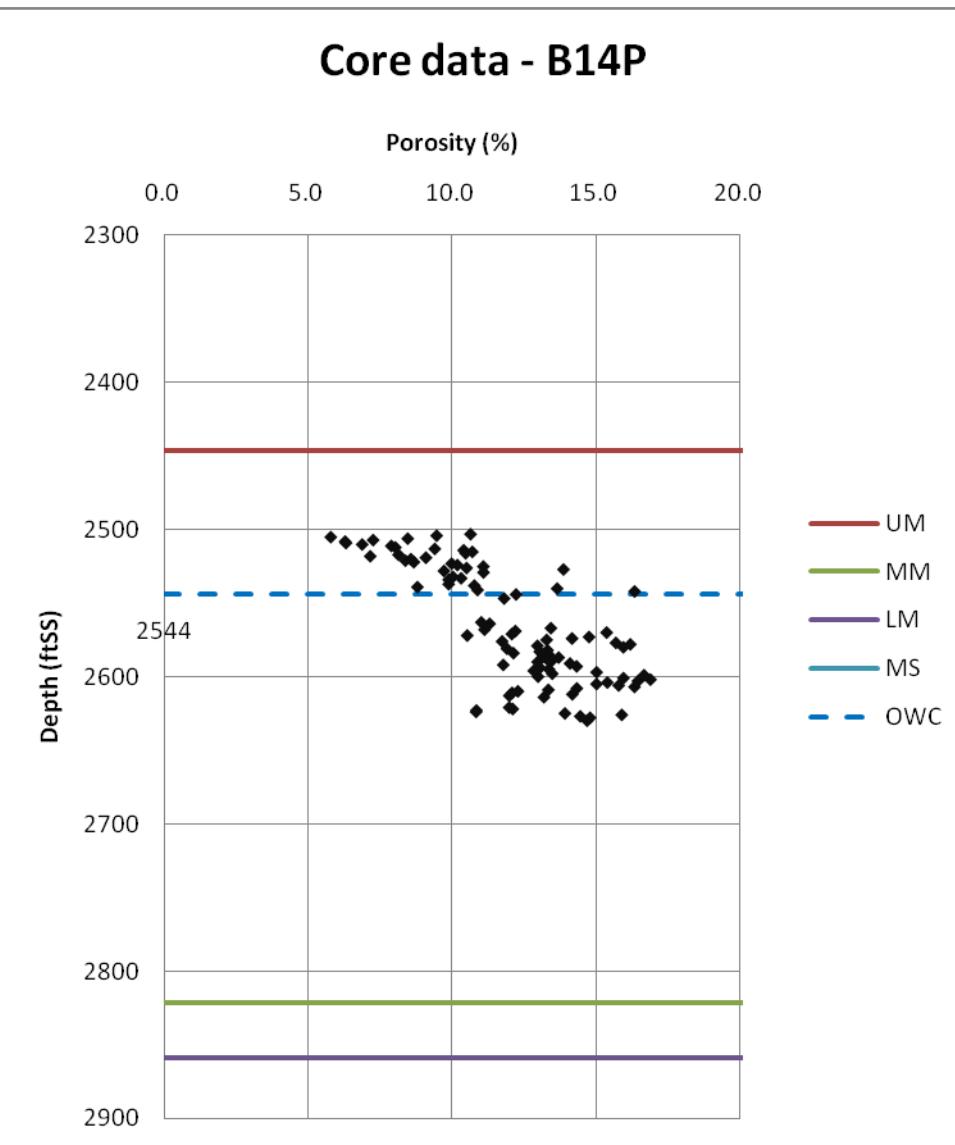
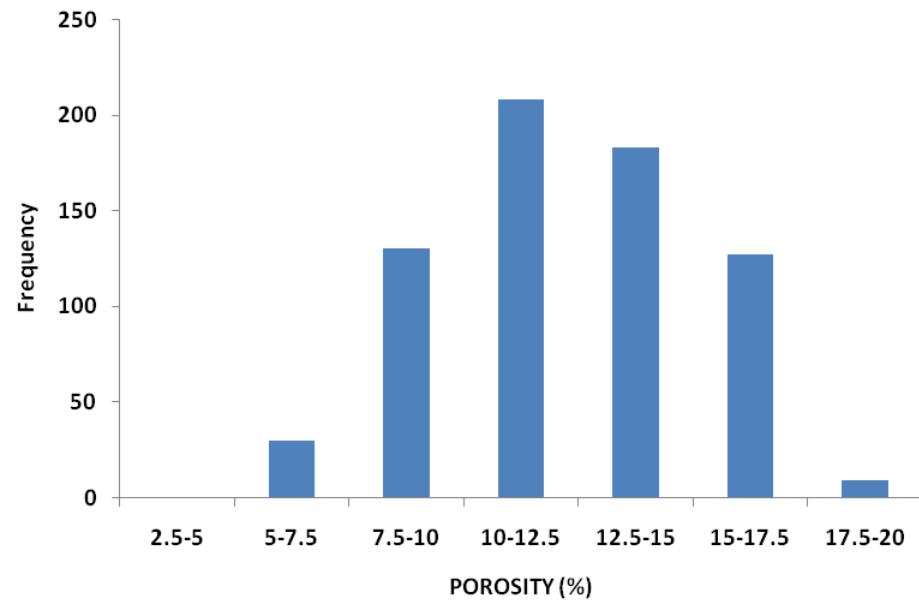
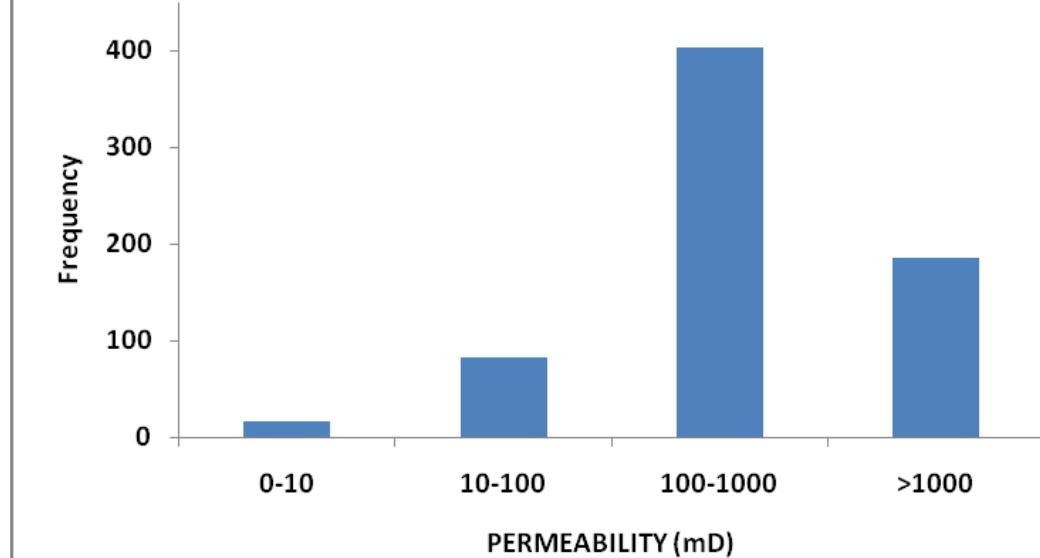
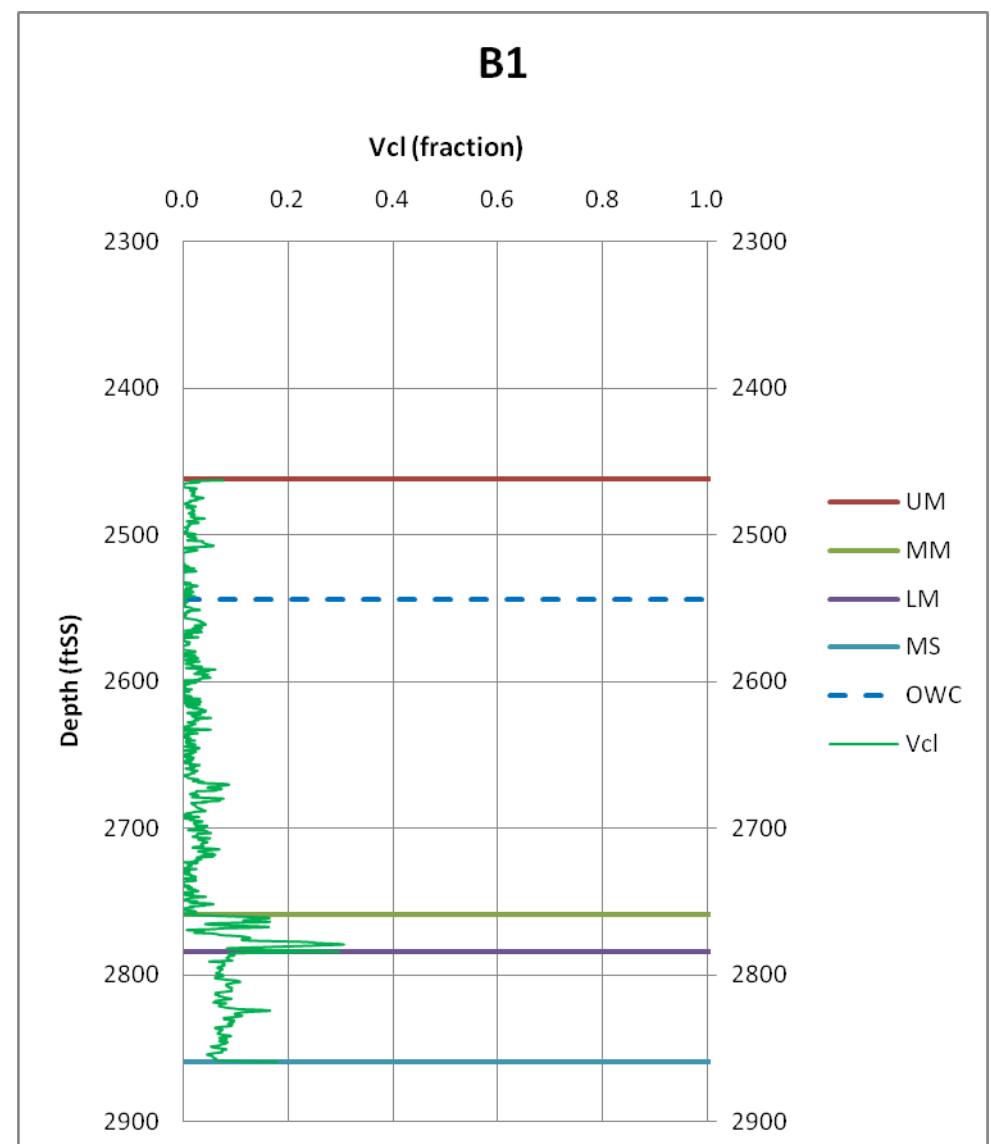
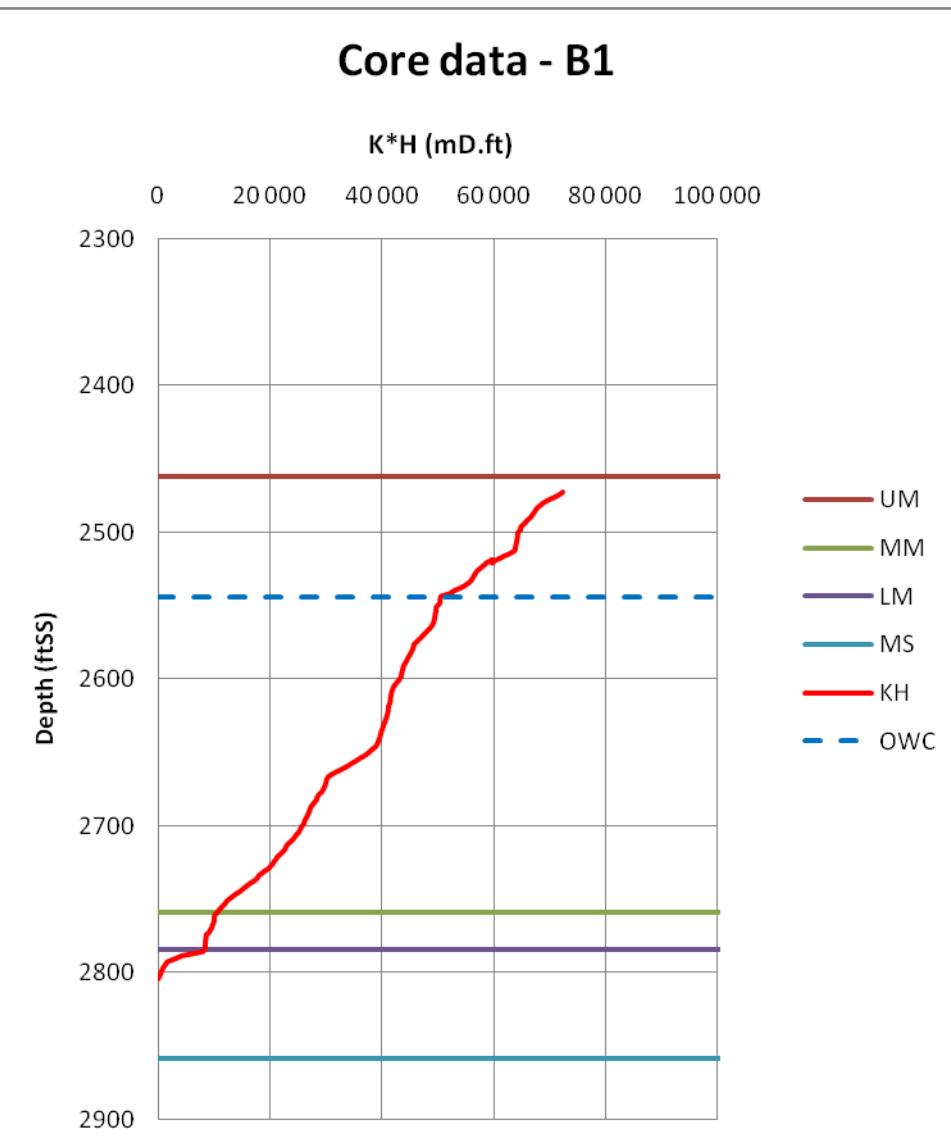


Fig. 5.35

B14P – Porosity and Permeability core measurements

Core data - Porosity Histogram**Core data - Permeability Histogram**

**B1 – Cumulative K.H and Vcl**

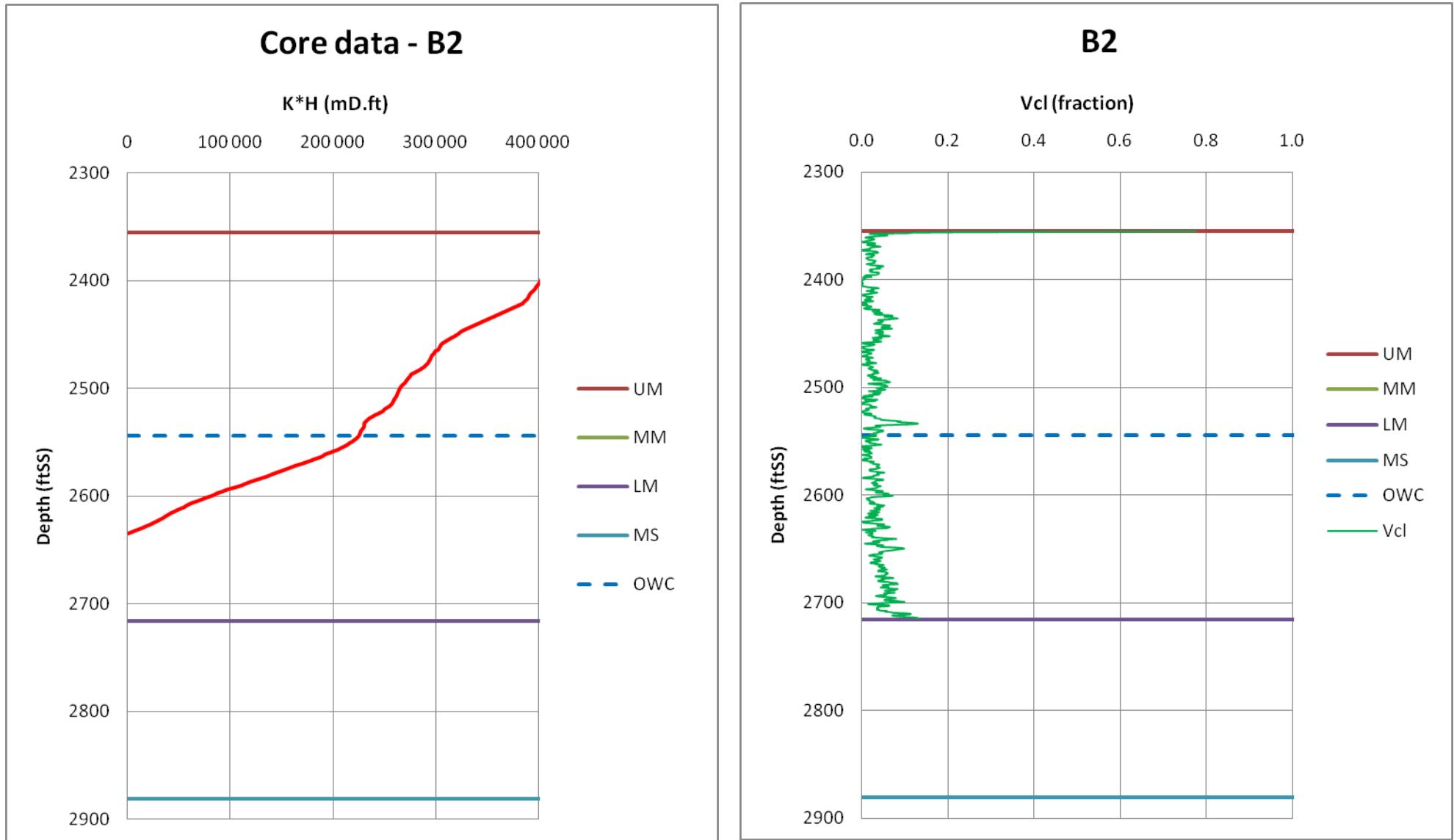
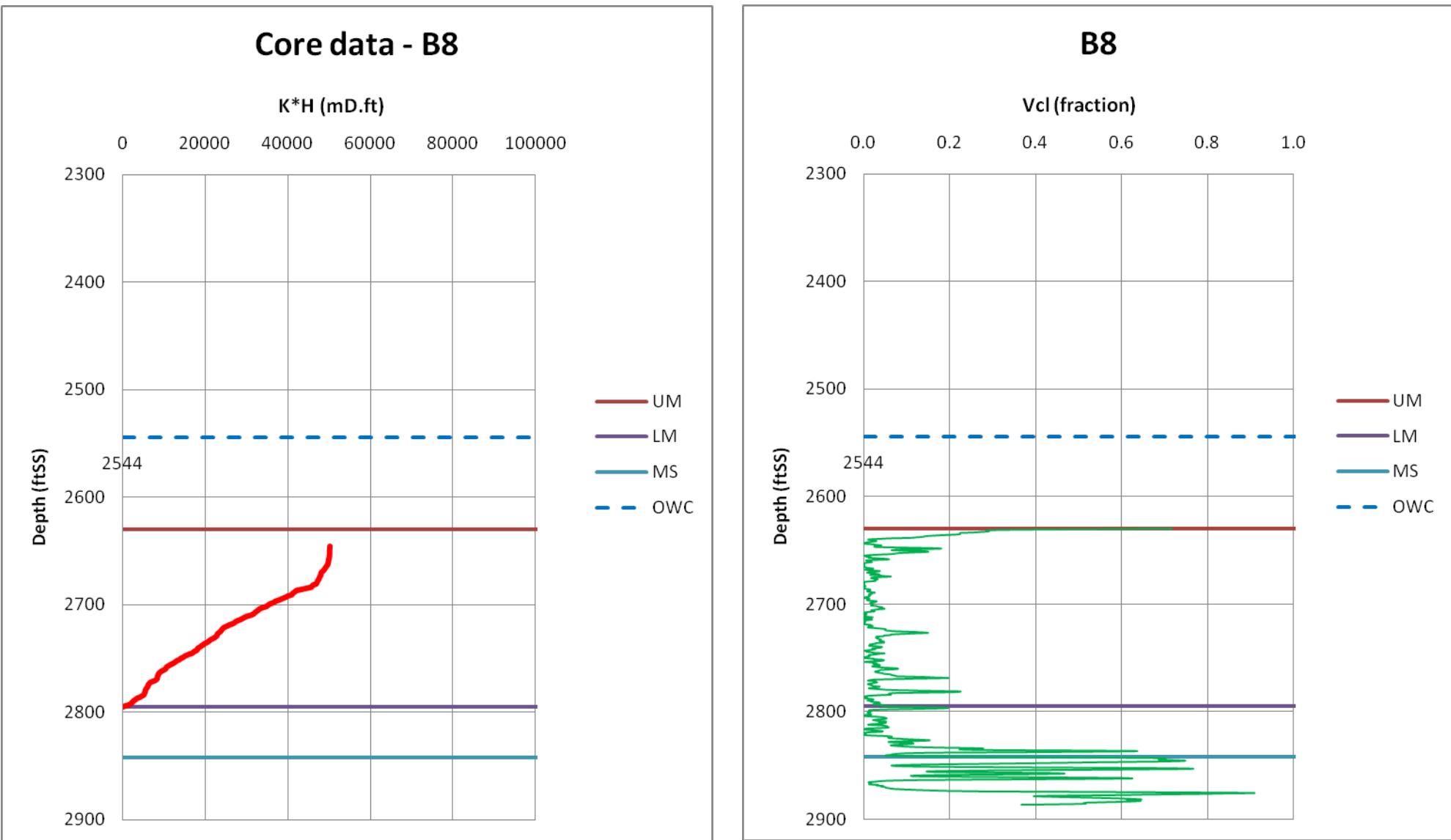
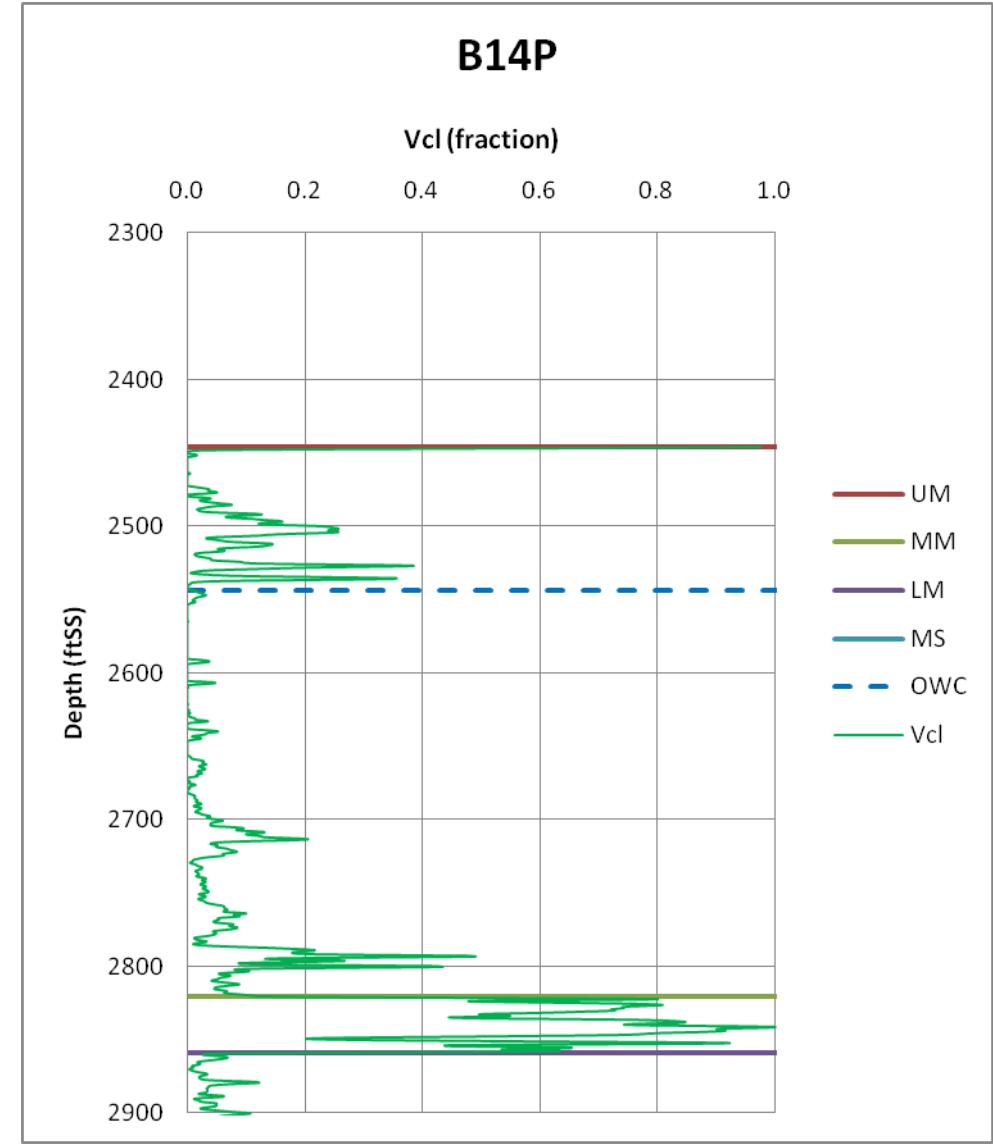
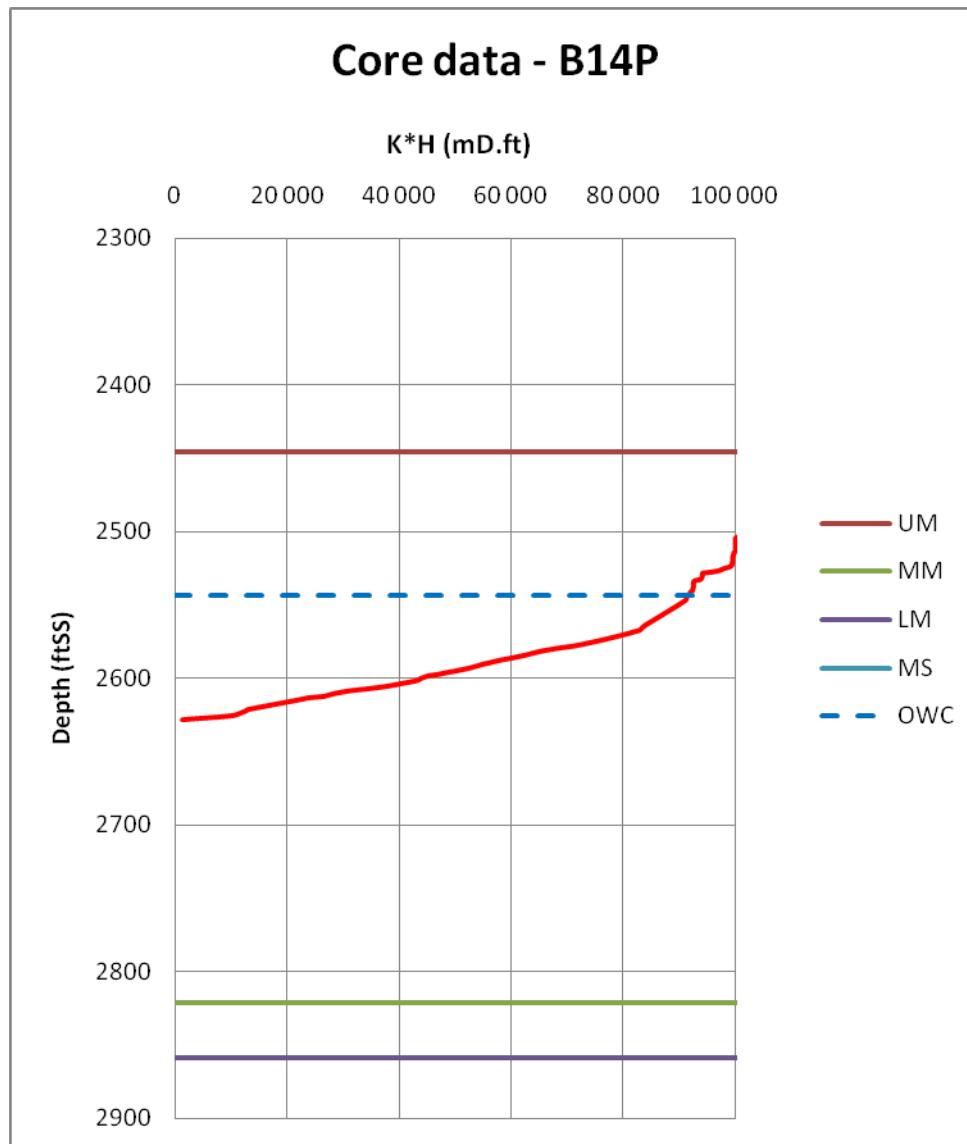


Fig. 5.38

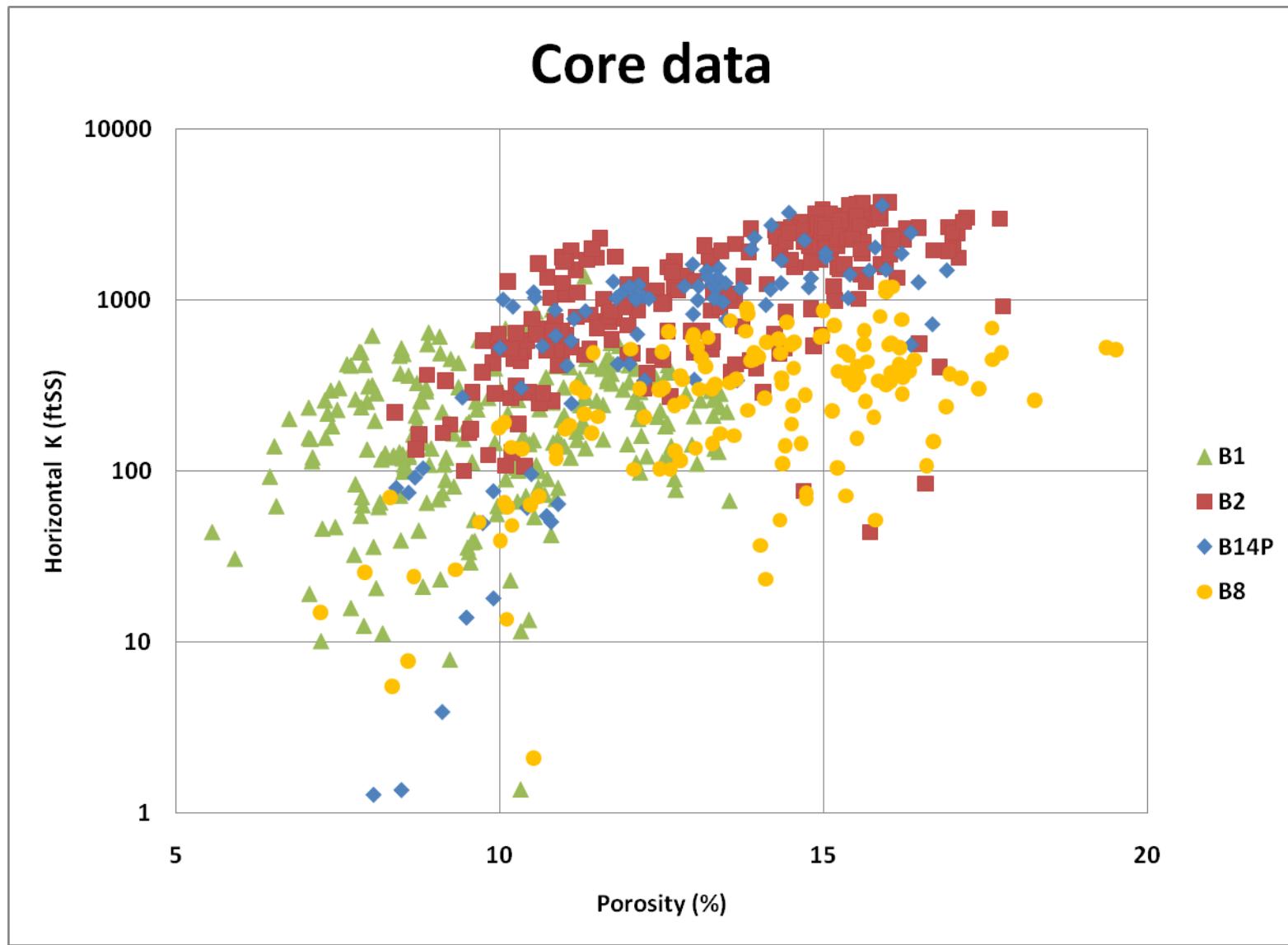
B2 – Cumulative K.H and Vcl



B8 – Cumulative K.H and Vcl

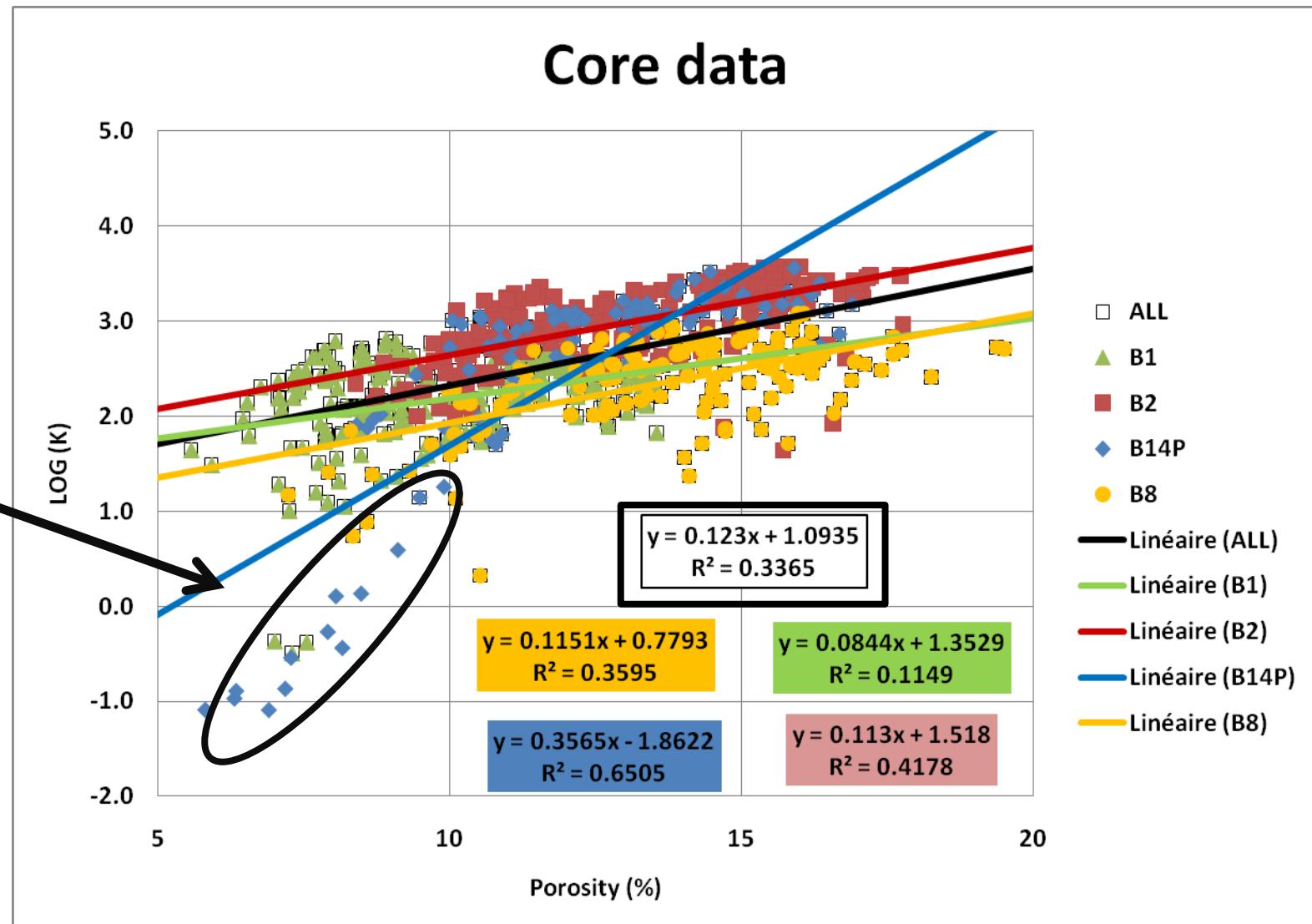


B14P – Cumulative K.H and Vcl



Porosity – Permeability plot from core data

Values outside the trend
not considered for the
regression



Porosity – Permeability regression

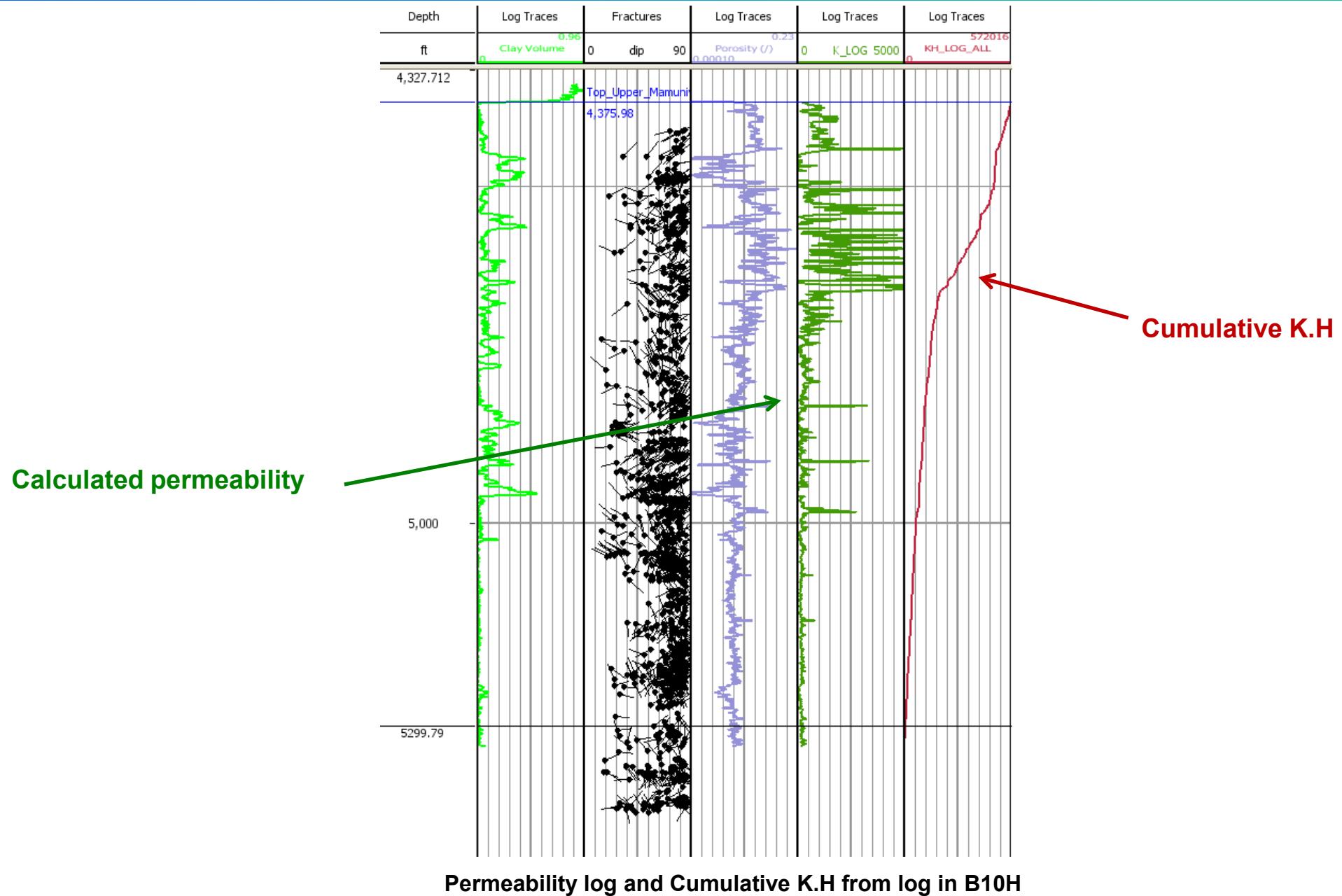


Fig. 5.43

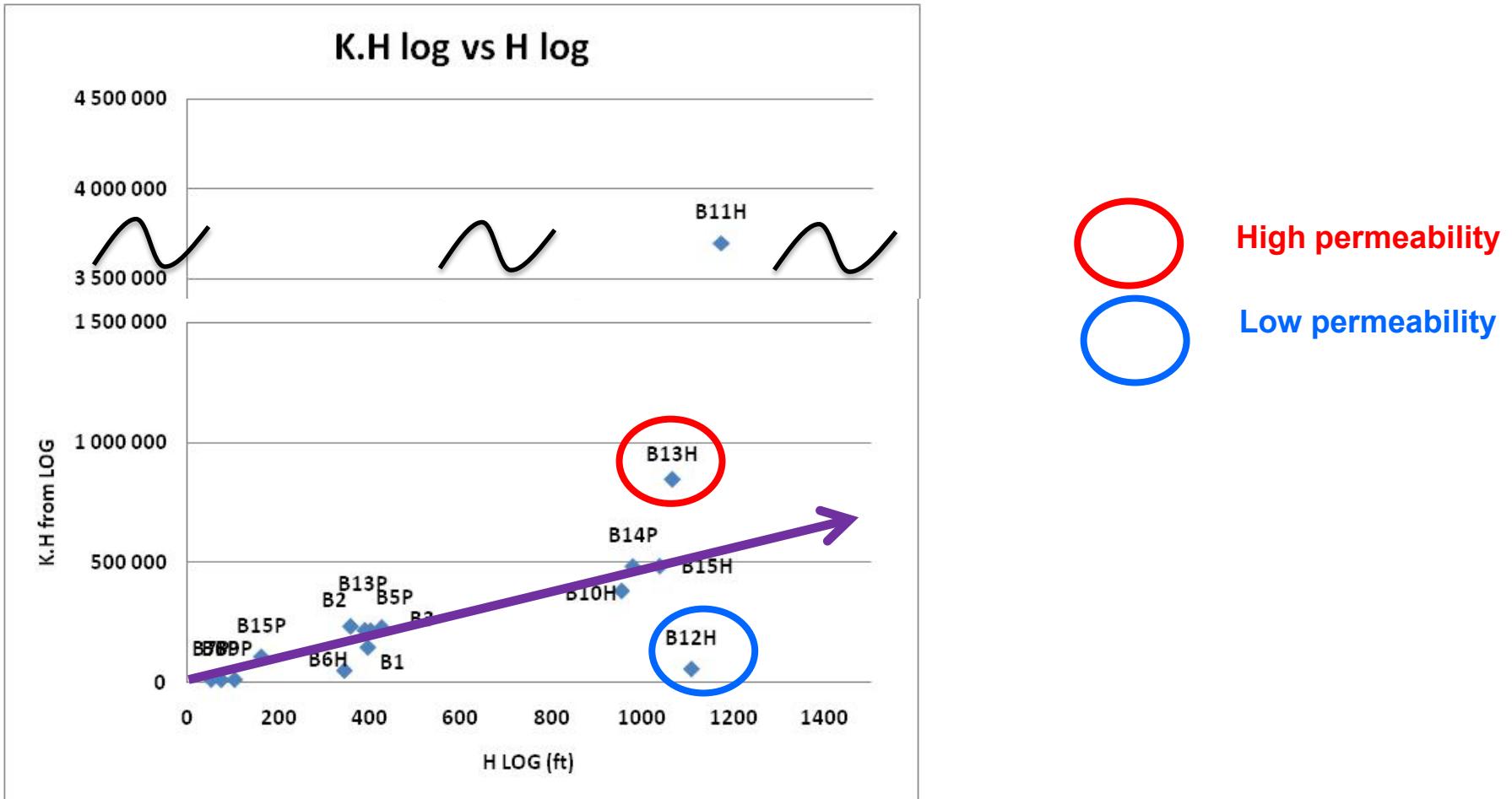
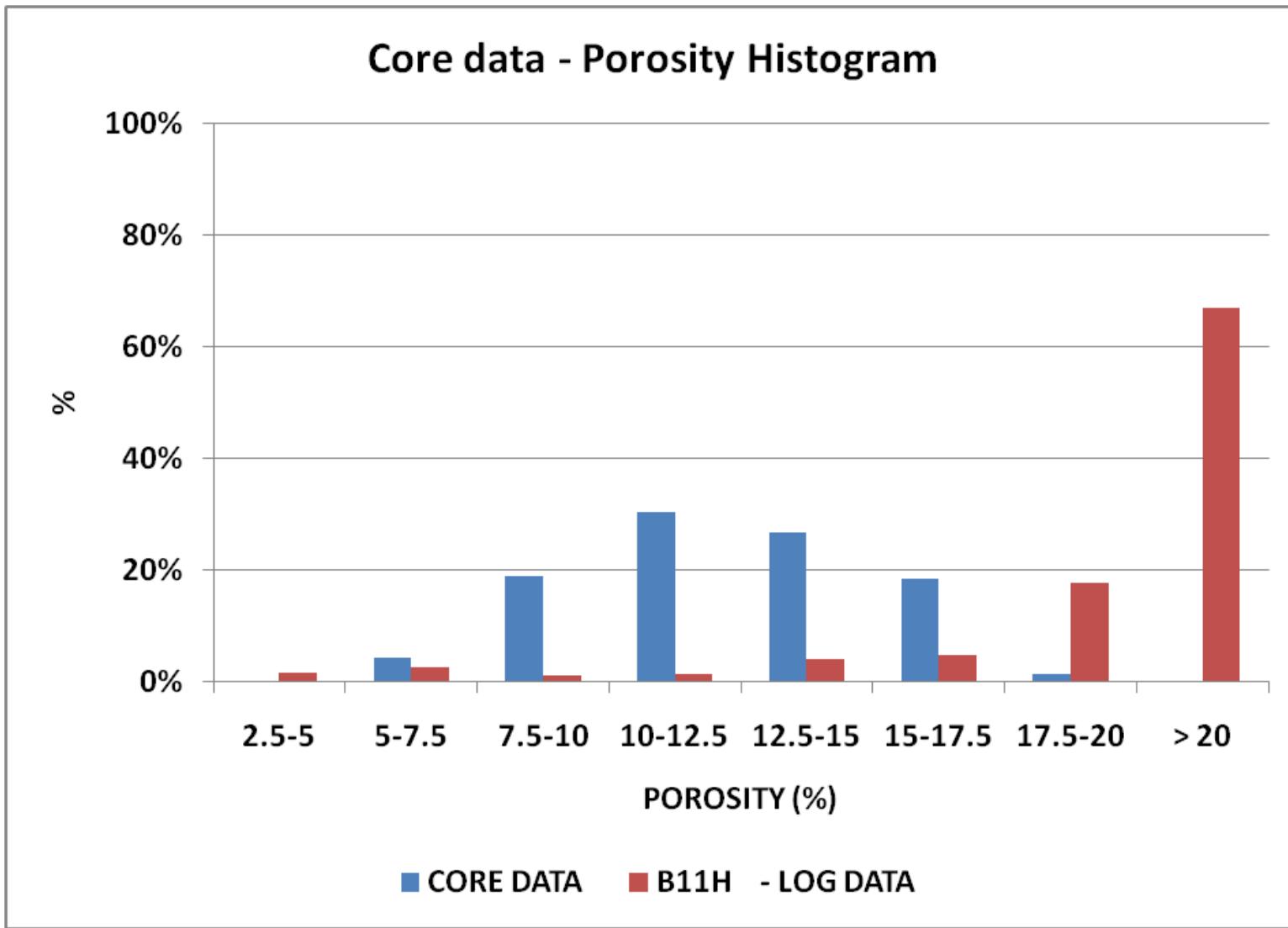


Fig. 5.44

K.H log per well versus H log



Comparison between Porosity in B11H (from log) and Core data

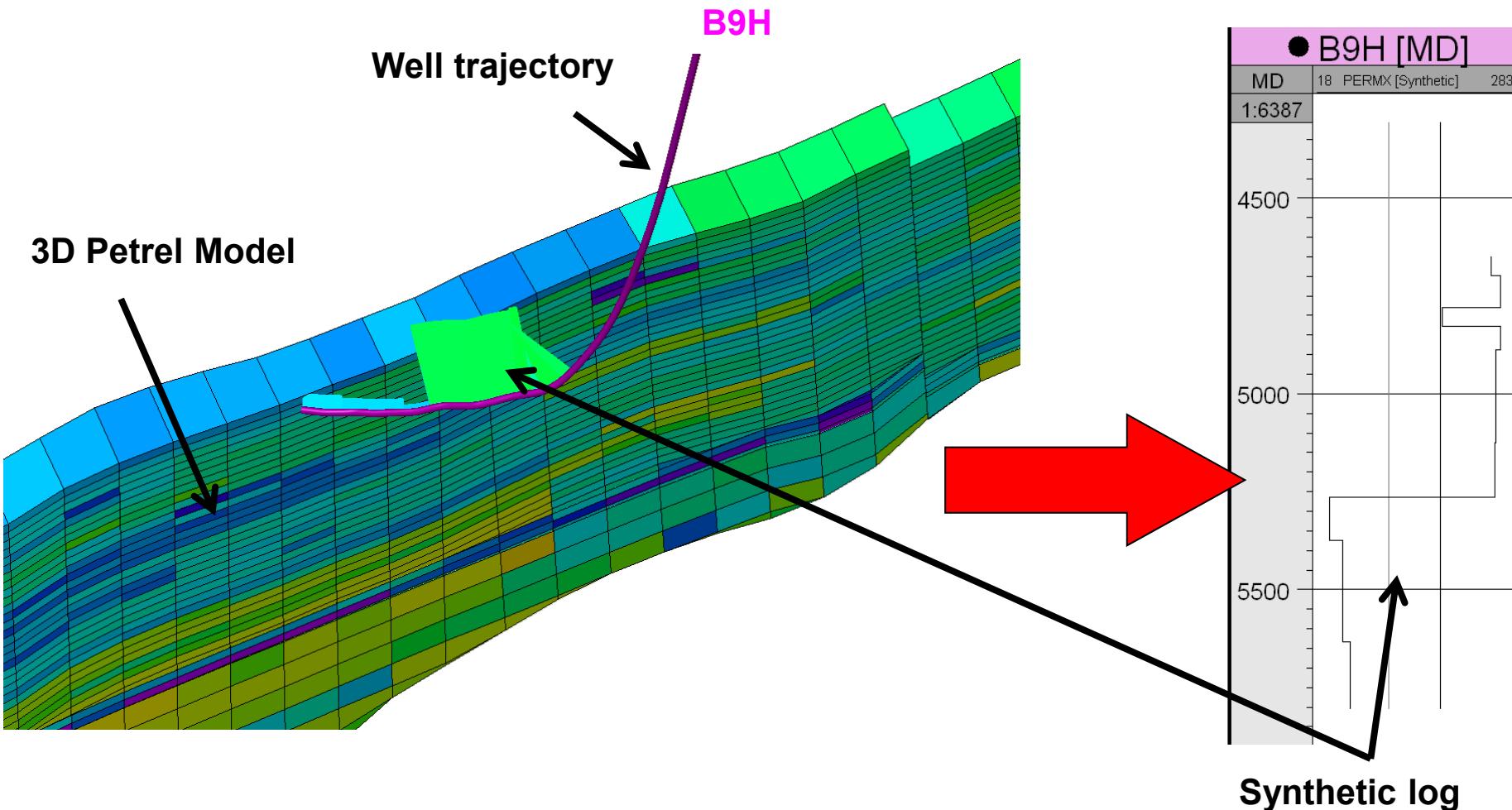


Fig. 5.46

Synthetic log extracted from 3D Petrel model: example of PERMX in B9H

		Na		Missing data																		
WELL	DATE	TEST	Interval (ft)	Type	BSW	PI (bbl/psi)	Well Model	Reservoir Model	K.H (md.ft)	H (ft)	K _H (mD)	K _V (mD)	K _V /K _H	Total Skin	Omega	Lambda	Type	Distance (ft)	Type	Length	Data quality	
B1	March 2001	DST-5	4190-4210	Perforated	0.0025	1	Vertical	Homogeneous	12470	86	145	*	*	36	*	*	*	*	*	*	*	Low
							Vertical	Homogeneous	12 470	81	154	*	*	36	*	*	*	*	*	*	*	Low
B2	February 2004	Production test	4008-4180	OpenHole	25%	48	Vertical	Radial composite	116 974	143	818	*	*	11.8	*	*	Discontinuity	160	*	*	*	Middle
								Homogeneous	115 830	143	810	*	*	13	*	*	*	*	*	*	*	Middle
								Dual Permeability	115 830	143	810	*	*	11.03	*	*	CPB	?	*	*	*	Middle
								Na	103 200	150	688	7	0.01	59	*	*	U-shape	1362	*	*	*	Na
B3	April 2004	Production test	3998-4096	OpenHole	60%	0.2	Vertical + limited fracture	Homogeneous	11 948	88.5	135	*	*	21	*	*	*	*	*	Limited Fracture	14 (1/2)	Middle
							Na	Na	16 200	120	135	Na	Na	21	Na	Na	Na	Na	Na	Na	Na	Na
B7H	March 2010	PLT	Na	OpenHole	21%	193.0	Horizontal	Homogeneous	58 590	135	434	66	0.15	10	*	*	*	*	*	*	*	Good
B9H	October 2007	Na	Na	OpenHole	0%	Na	Horizontal	Homogeneous	11 760	84	140	41	0.29	9.5	*	*	3 no flow	1300 (for 3)	*	*	Good	
		Na	Na					Dual Poro	8 024	68	118	4	0.03	20	0.09	1.90E-08	2 faults (120°)	1206	*	*	Na	Na
		Na	Na					Dual Poro	5 848	68	86	0.15	0.002	45	0.008	8.50E-10	*	*	*	*	*	Good
B10H	April 2009	Production test	Na	OpenHole	15%	40.0	Horizontal	Dual Poro	441 438	177	2494	129	0.05	-3.5	0.38	0.003	*	*	*	*	*	Middle
							Horizontal + limited fracture	Single Poro	340 194	177	1922	*	*	-3.5	*	*	*	*	*	Limited Fracture	Na	Middle
B11H	October 2009	BU	NA	OpenHole	26%	1.0	Horizontal	Dual Poro	7 560	120	63	12	0.19	32	0.99	4.50E-04	CPB	120	*	*	Good	
								Homogeneous	7 560	120	63	2	0.03	65	*	*	*	*	*	*	Good	
B12H	April 2010	PLT	Na	OpenHole	27%	154.0	Horizontal	Homogeneous	348 755	93.3	3738	23172	6.20	20.1	*	*	*	*	*	*	*	Low
B14H	February 2009	Production test	Na	OpenHole	0%	12.0	Horizontal	Homogeneous	57 096	104	549	15	0.03	24	Na	Na	Closed	15000*8000 (*2)	*	*	Middle	
								Dual Poro	49 920	104	480	35	*	37	0.035	2.50E-06	Parallel Faults	4047 - 79757	*	*	Na	Na
B15H	January 2010	Production test	Na	OpenHole	0%	59.0	Horizontal	Dual Poro	96 390	70	1377	25	0.02	10	0.21	3.40E-10	*	*	*	*	*	Low

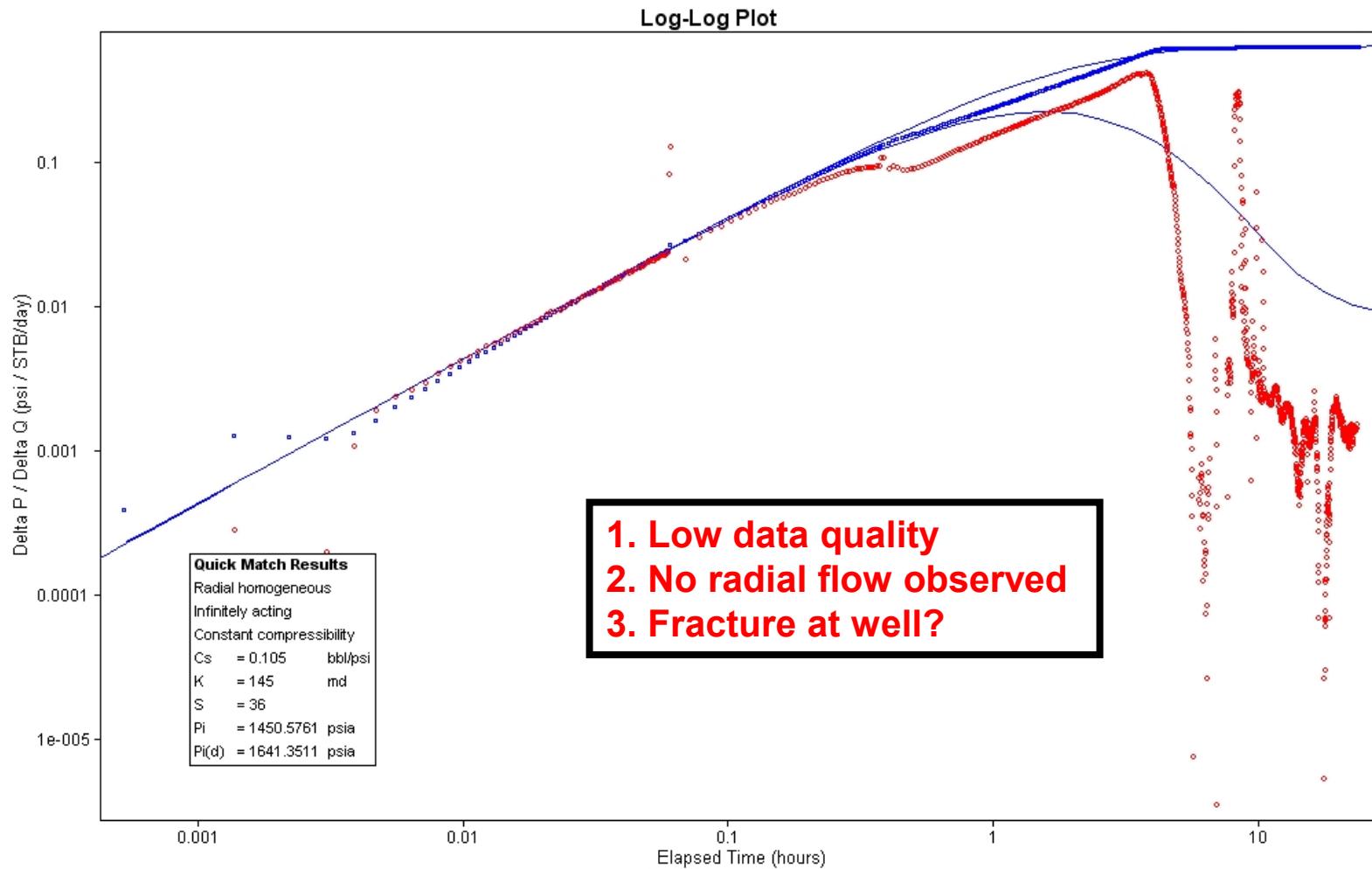


Fig. 5.48

B1 Well test – March 2001 – INTERPRETATION

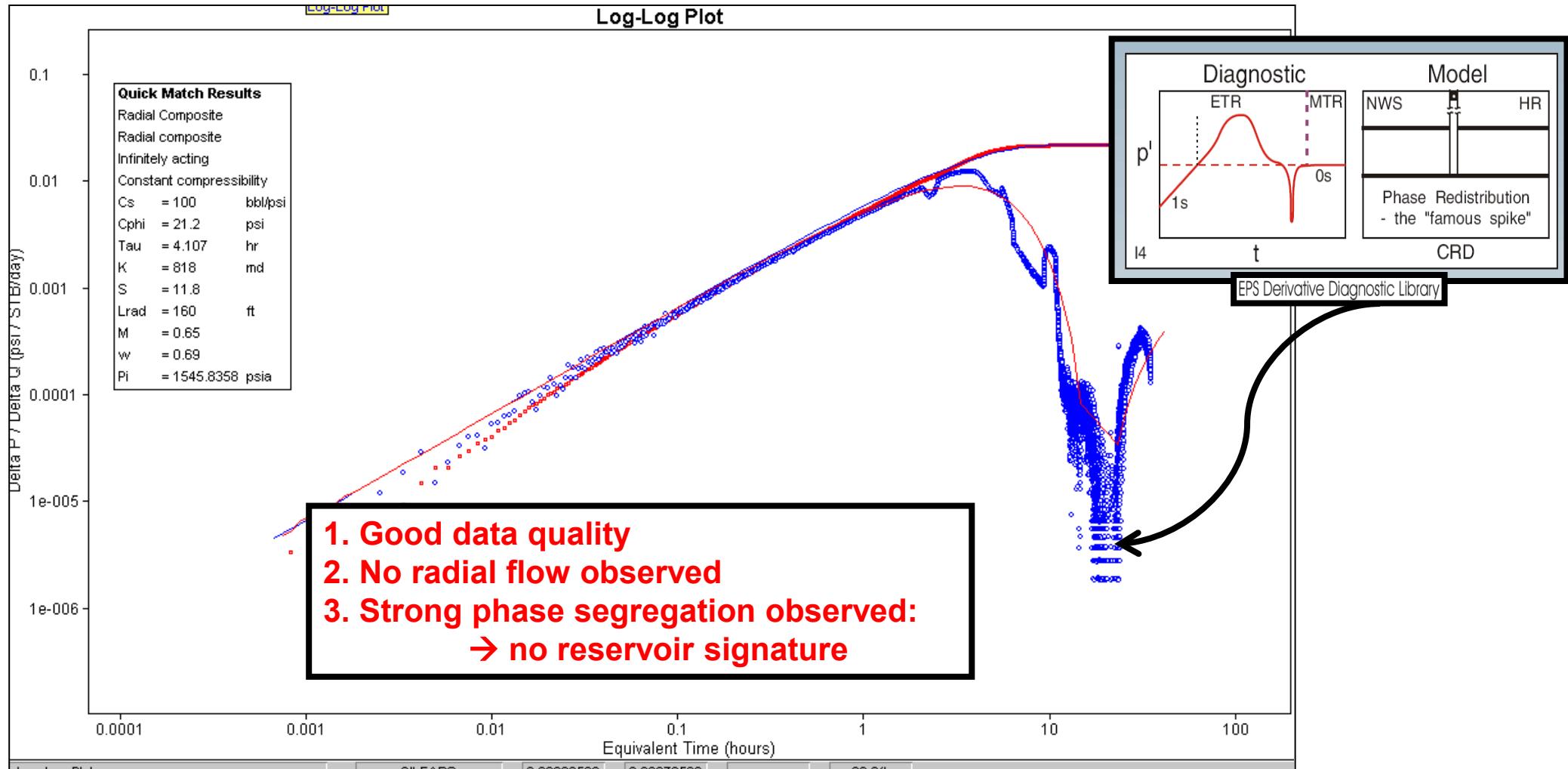
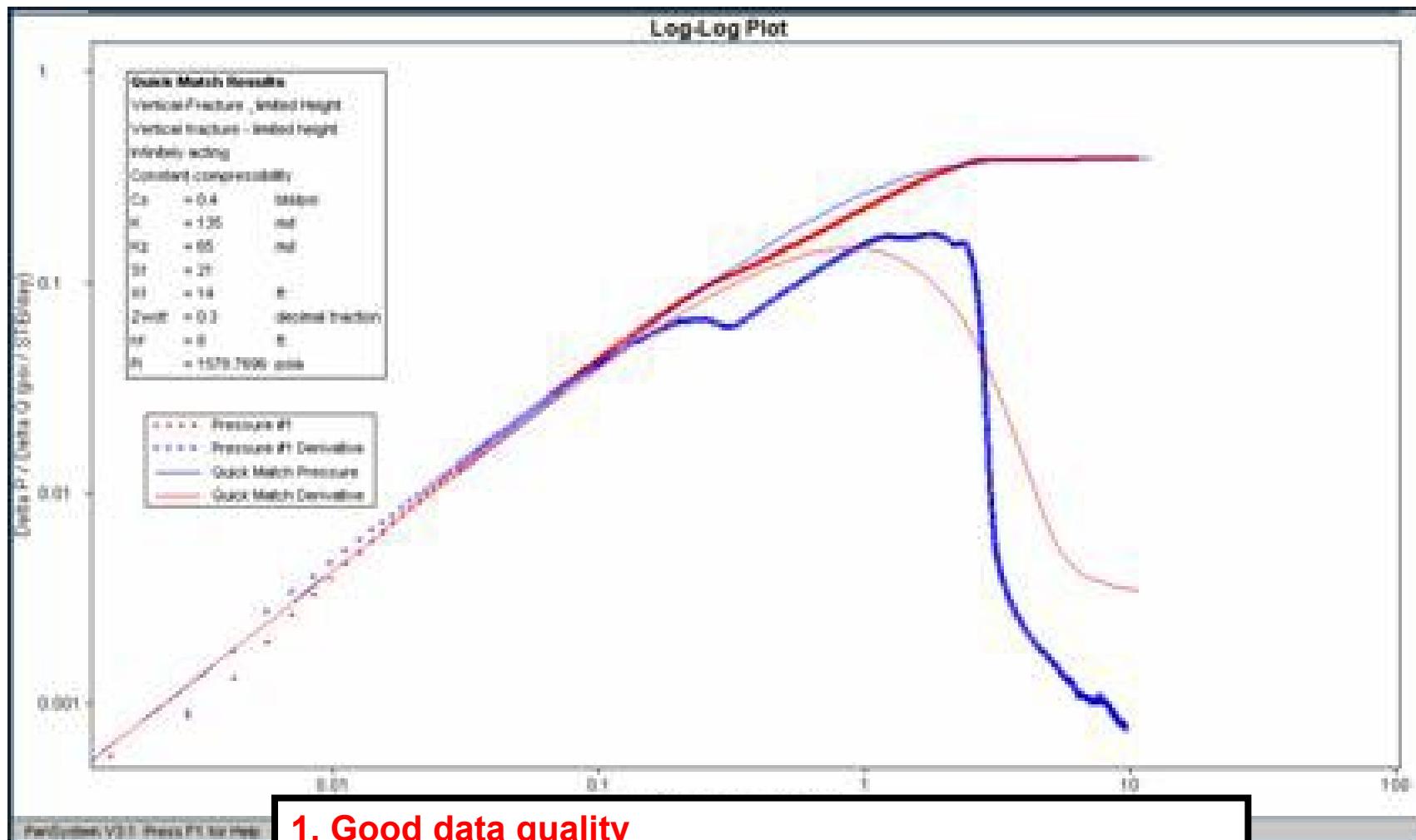


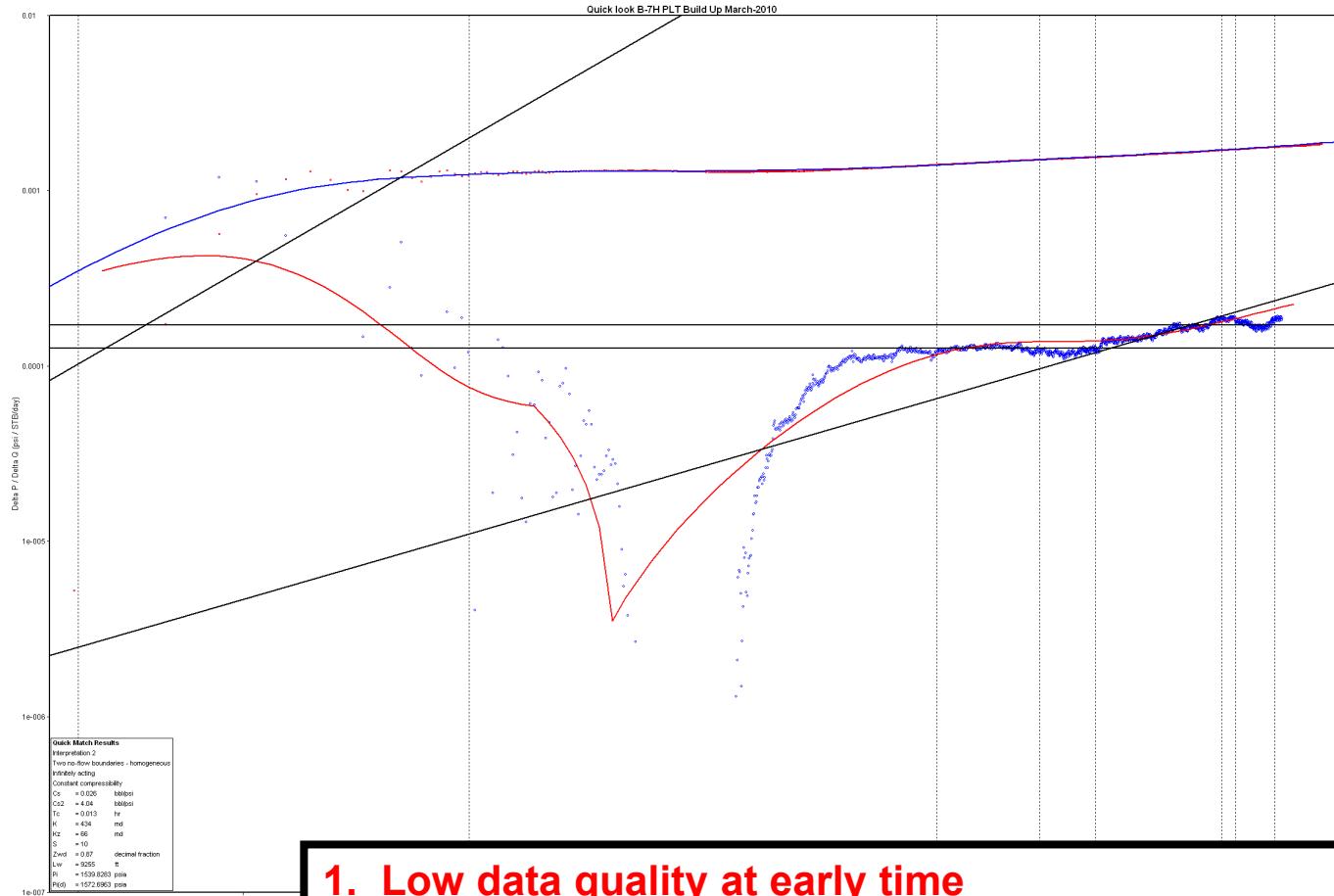
Fig. 5.49

B2 Well test – February 2004 – INTERPRETATION



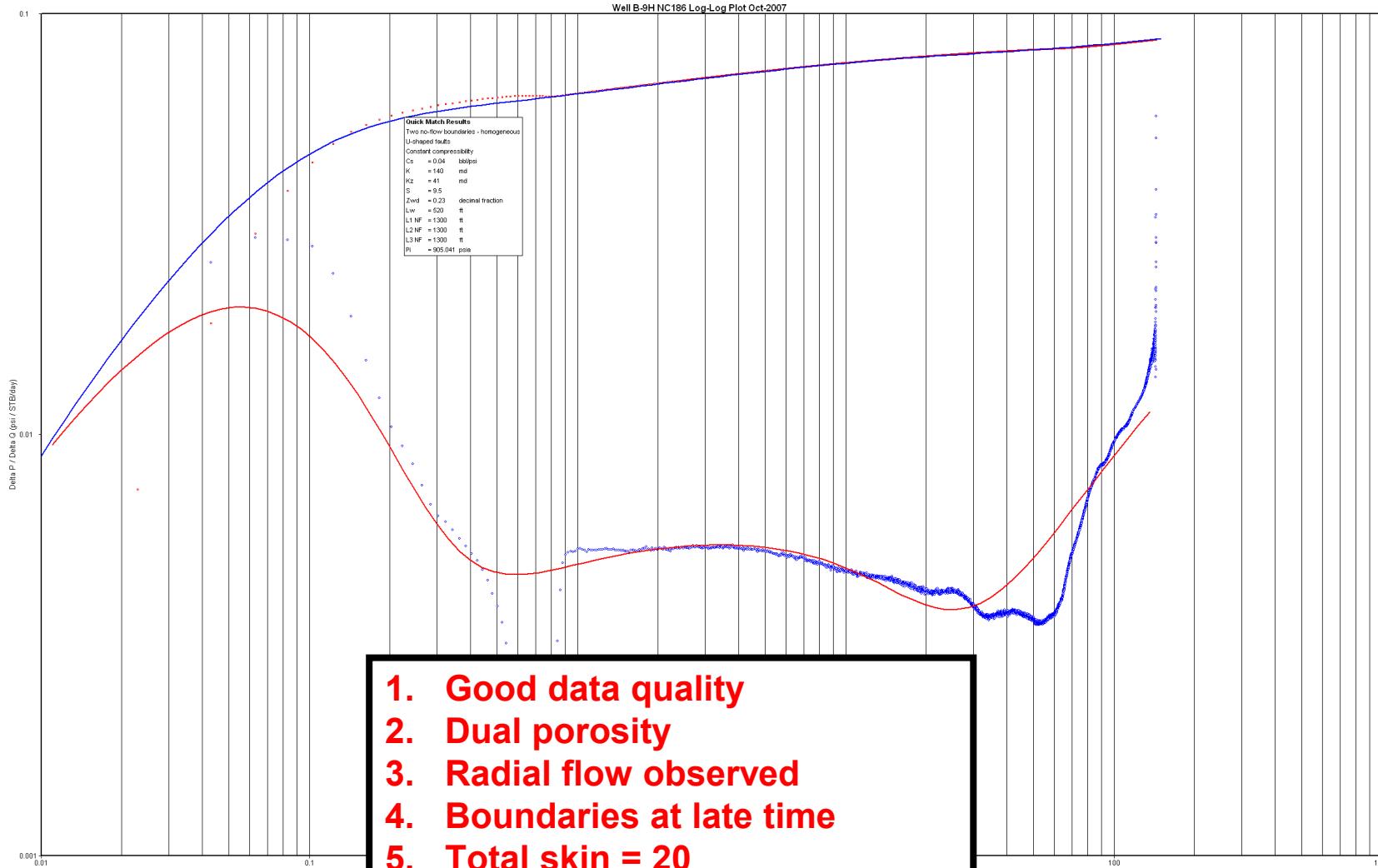
1. Good data quality
2. Test too short
3. Strong increasing wellbore storage not interpreted
4. No radial flow observed

B3 Well test – April 2004 – INTERPRETATION



1. Low data quality at early time
2. Good data quality for late time
→Horizontal well signature
→Radial flow observed
3. Test too short to see boundaries (< 10 hours)
4. Total skin = 10

B7H Well test – March 2010 – INTERPRETATION



Dual porosity model was selected for the second interpretation but no picture was available

B9H Well test – October 2007 – INTERPRETATION

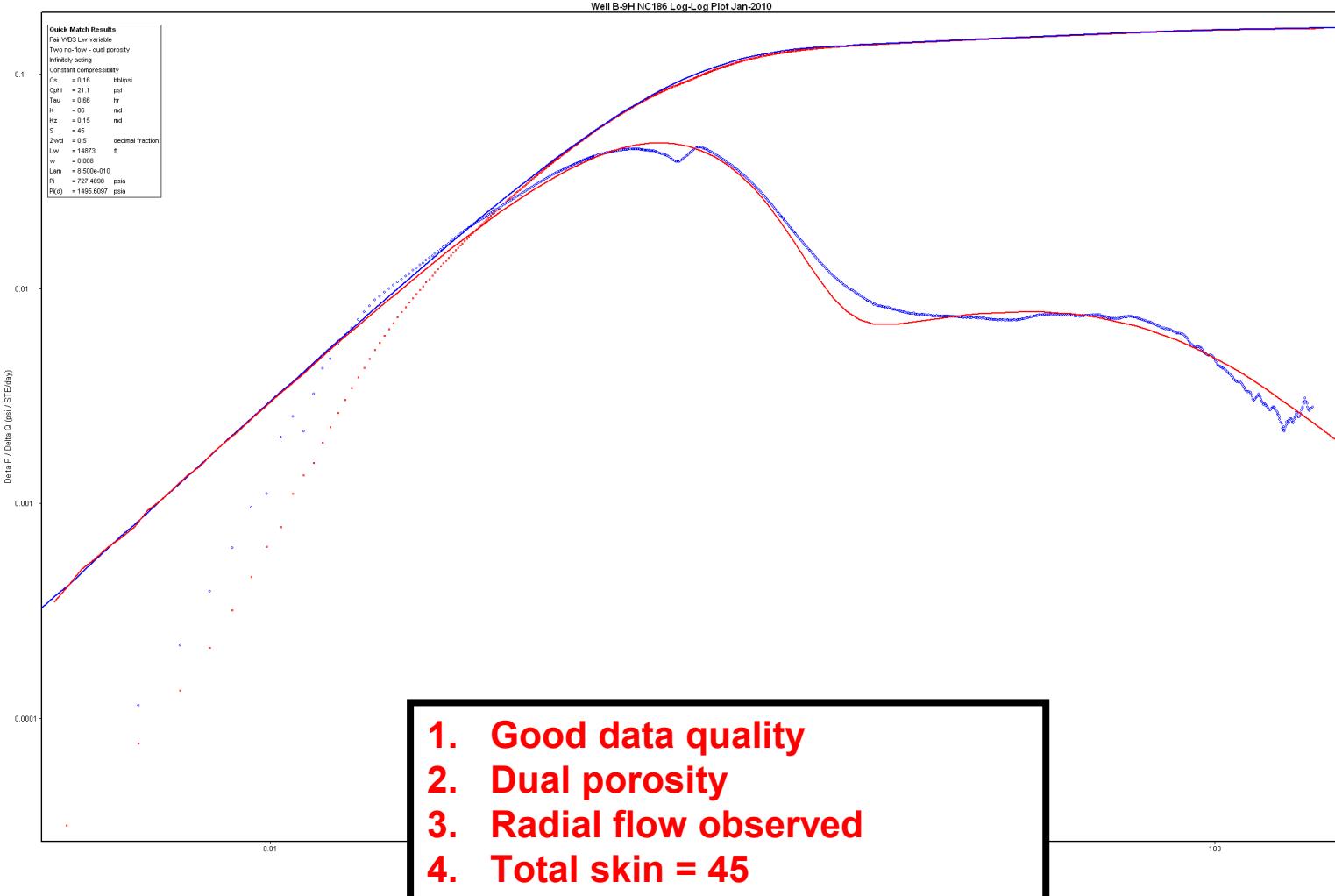


Fig. 5.53

B9H Well test – January 2010 – INTERPRETATION

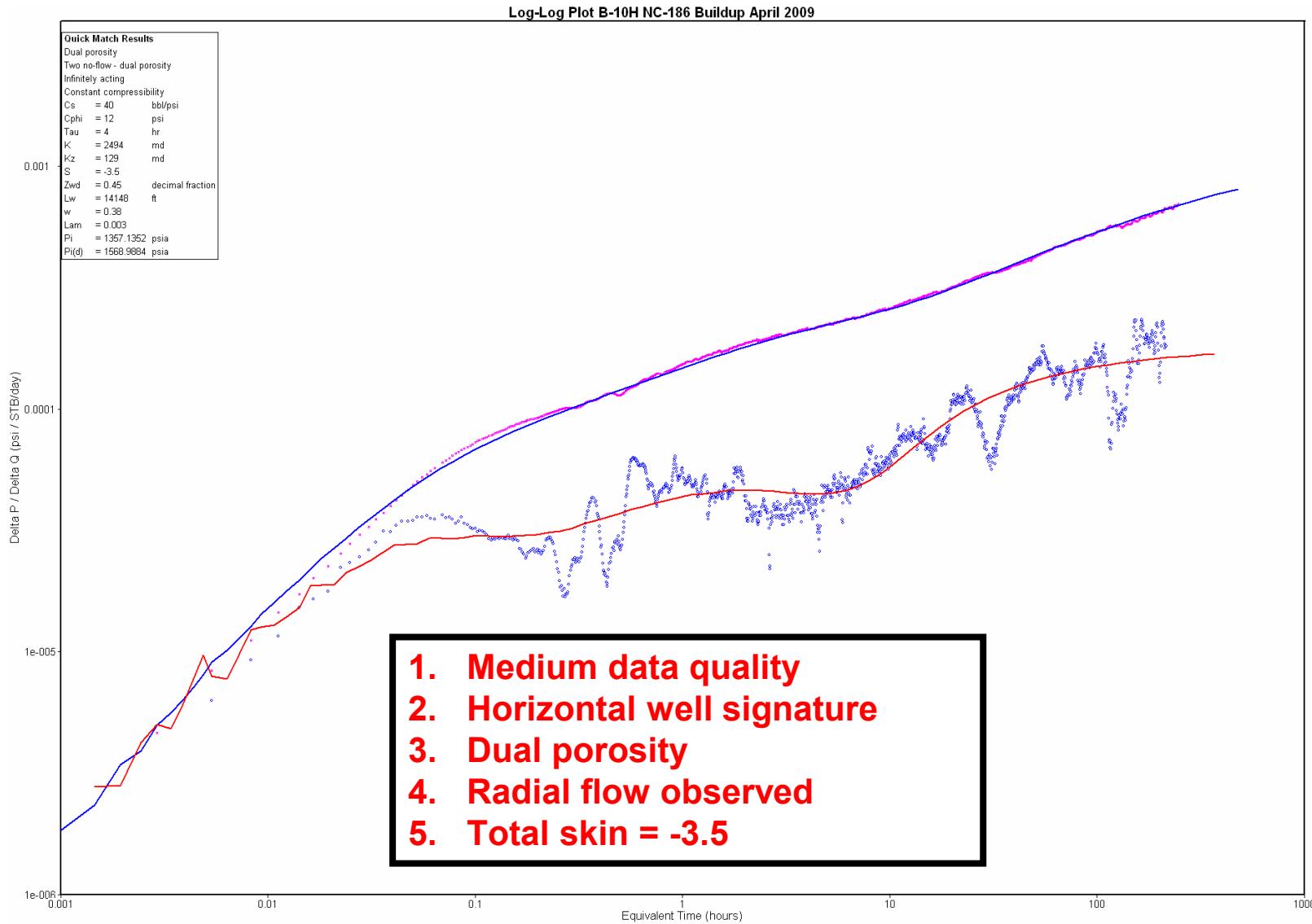
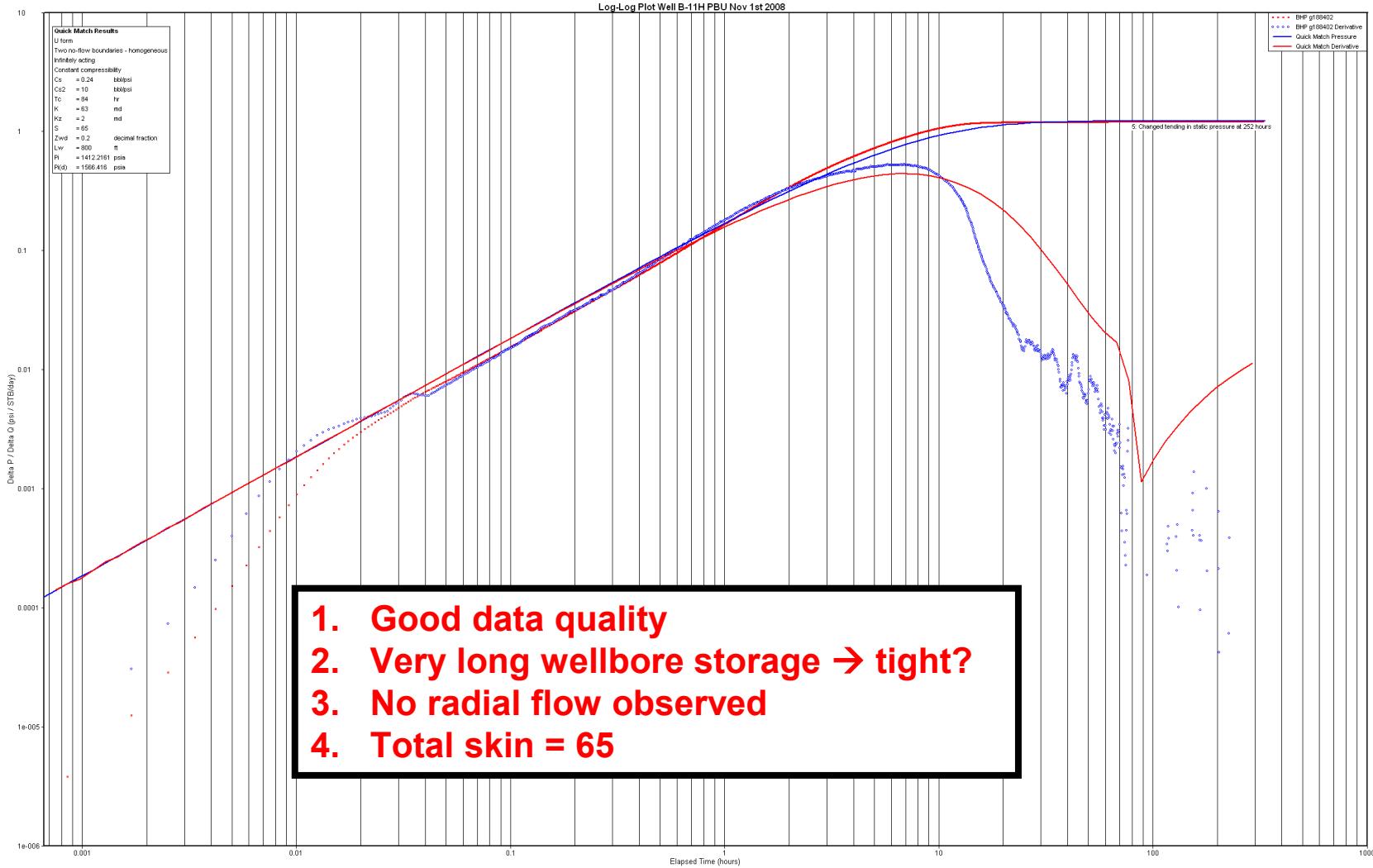
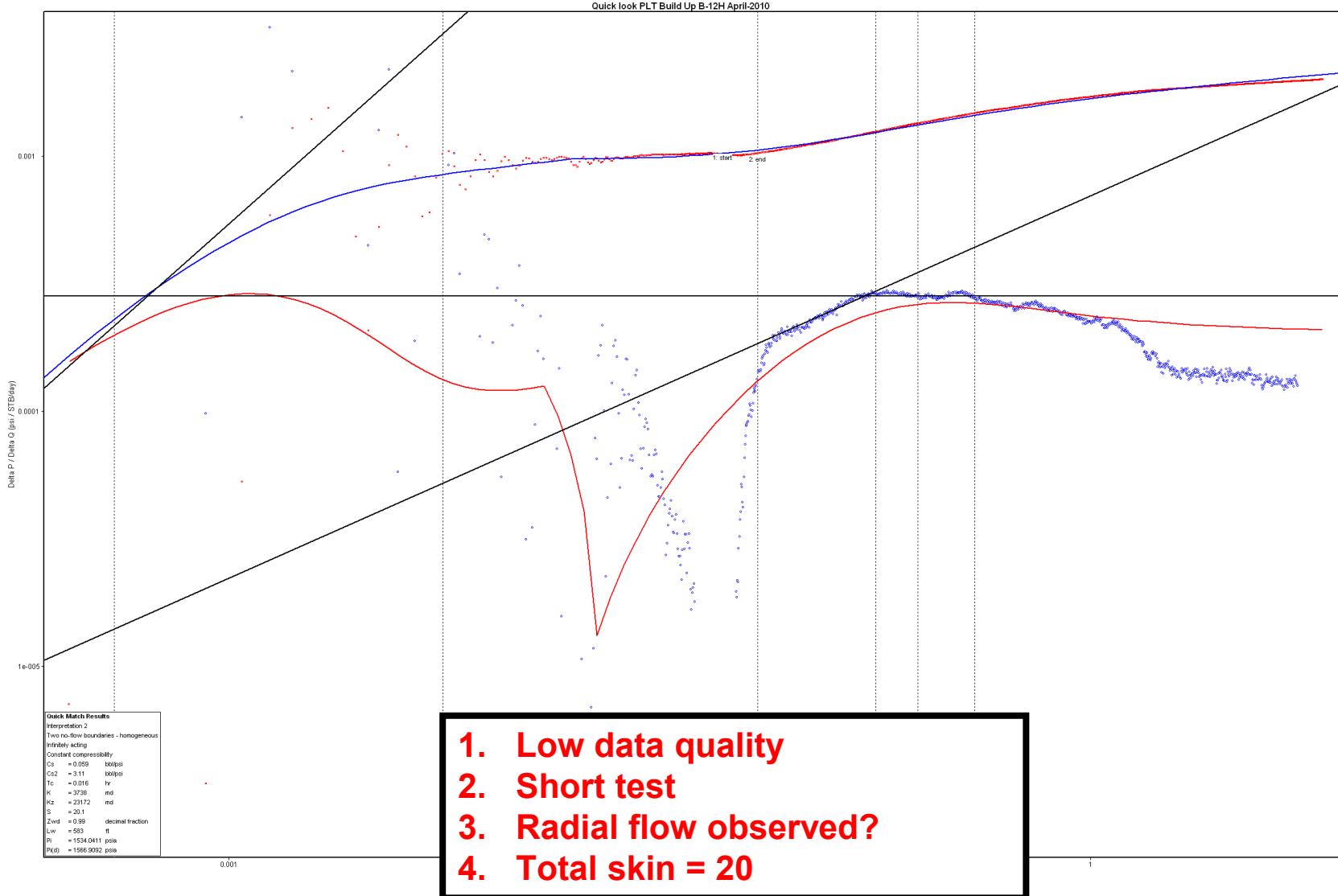


Fig. 5.54

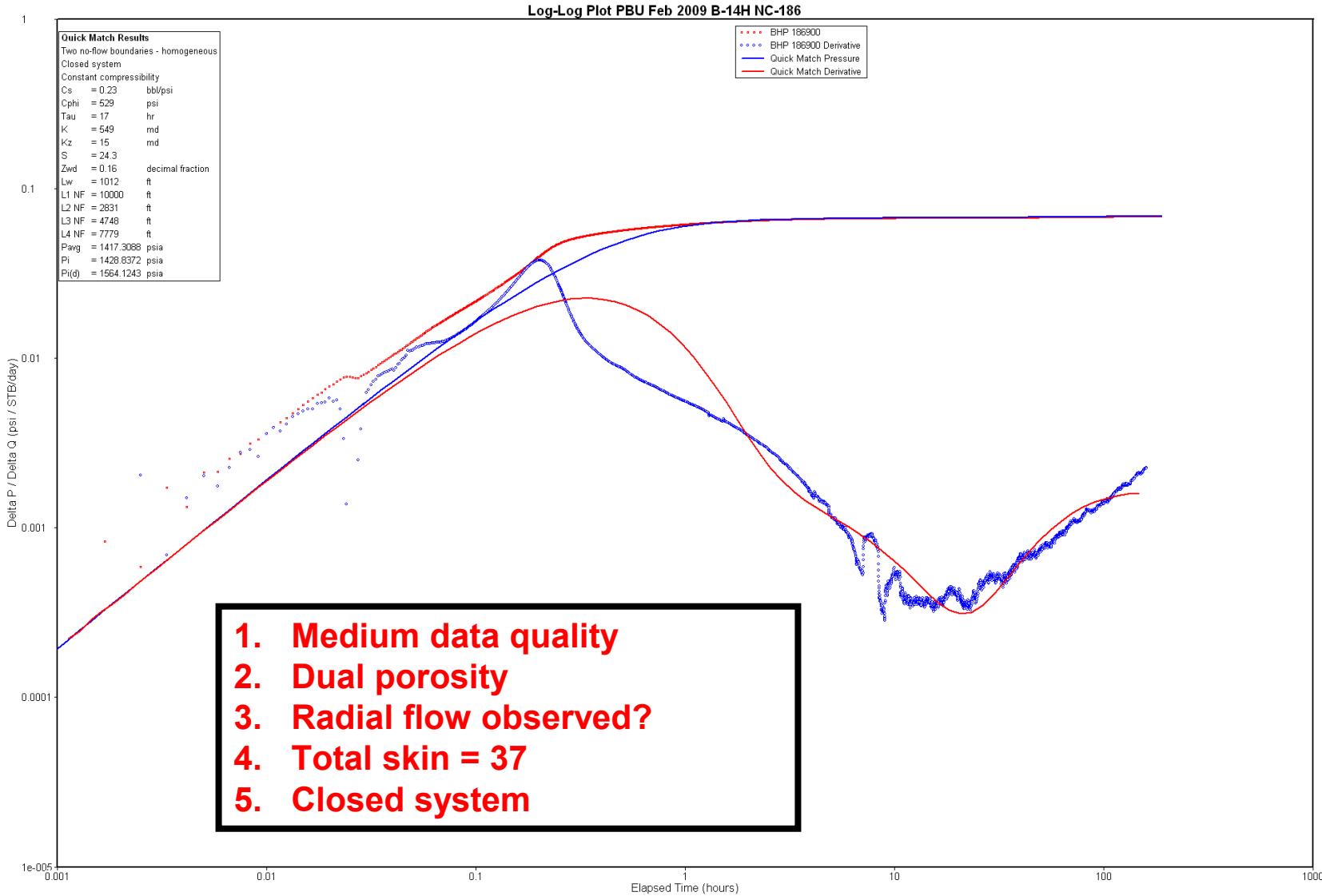
B10H Well test – April 2009 – INTERPRETATION



B11H Well test – October 2009 – INTERPRETATION



B12H Well test – April 2010 – INTERPRETATION



B14H Well test – February 2009 – INTERPRETATION

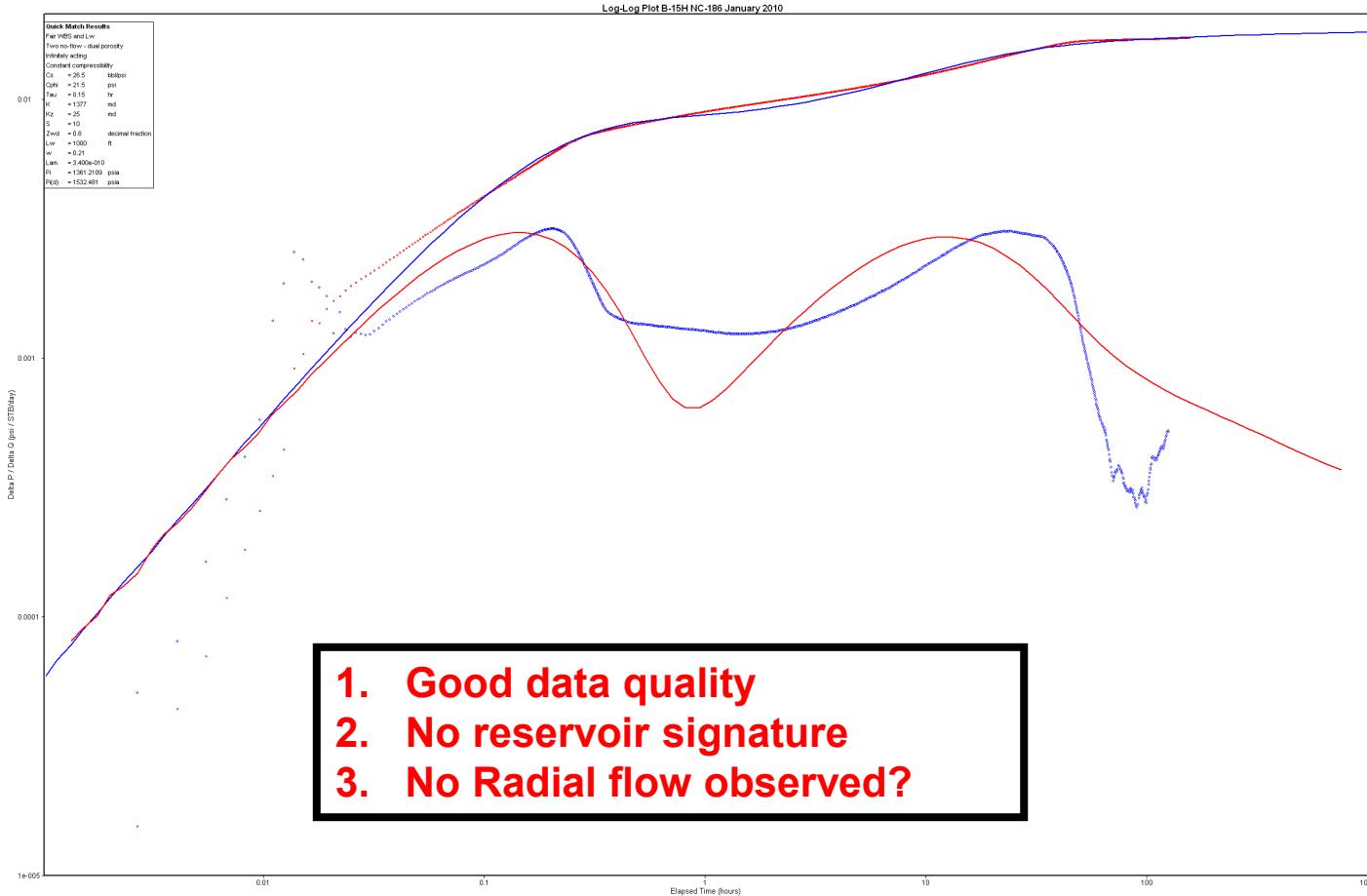
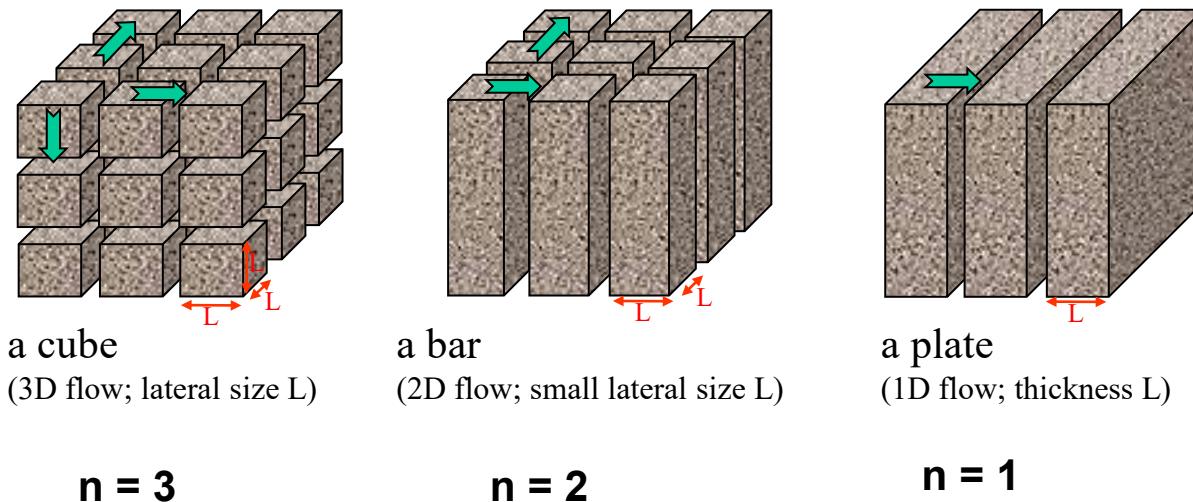


Fig. 5.58

B15H Well test – January 2010 – INTERPRETATION



		DATA						CALCULATION					
		Omega	Lambda	PHI matrix	K test	Km	rw	PHI fracture %		Sigma	Spacing	Aperture (ft)	
		-	-	%	mD	mD	ft	Cf = 10.Cm	Cf=Cm	1/ft2	ft	Cf = 10.Cm	Cf=Cm
B9H	October 2007	0.09	1.90E-08	7.44	118	105	0.7083	0.07	0.74	4.2557E-08	27 421	20.2	201.8
	January 2010	0.008	8.50E-10	7.44	86	105	0.7083	0.01	0.06	1.38756E-09	151 862	9.1	91.1
B10H	April 2009	0.38	0.003	10.90	2494	600	0.7083	0.67	6.68	0.024853726	36	0.2	2.4
B11H	October 2009	0.99	4.50E-04	19.42	63	3645	0.7083	192.26	1922.58	1.55017E-05	1 437	2762.3	27622.9
B14H	February 2009	0.035	2.50E-06	8.59	480	154	0.7083	0.03	0.31	1.55305E-05	1 435	0.4	4.5
B15H	January 2010	0.21	3.40E-10	12.33	1377	698	0.7083	0.33	3.28	1.33685E-09	154 715	507.1	5070.9

Na	Missing data
*	No data needed

WELL	DATE	TEST	BSW	PI (bbl/psi)	Well Model	Reservoir Model	K.H (md.ft)	Data quality	VALIDATED	REASON
B1	March 2001	DST-5	0.25%	1	Vertical	Homogeneous	12 470	Low		LOW QUALITY
					Vertical	Homogeneous	12 470	Low		
B2	February 2004	Production test	25%	48	Vertical	Radial composite	116 974	Middle		NO RESERVOIR SIGNATURE PHASE SEGREGATION
						Homogeneous	115 830	Middle		
						Dual Permeability	115 830	Middle		
B3	April 2004	Production test	0%	0.8	Vertical + partial penetration	Na	103 200	Na		Na
B7H	March 2010	PLT	21%	193.0	Horizontal	Homogeneous	58 590	Good	Y	OK
						Na	11 948	Middle		BU TOO SHORT NO RADIAL FLOW
B9H	October 2007	Na	0%	11.5	Horizontal	Homogeneous	11 760	Good		The reinterpretation is better
						Dual Poro	8 024	Na	Y	OK
						Dual Poro	5 848	Good		OK BUT PREVIOUS TEST PREFERRED AS BSW=0%
B10H	April 2009	Production test	15%	40.0	Horizontal	Dual Poro	441 438	Middle	Y	OK
						Horizontal + limited fracture	340 194	Middle		Na
B11H	October 2009	BU	26%	1.0	Horizontal	Dual Poro	7 560	Good		NO RADIAL FLOW
						Homogeneous	7 560	Good		NO RADIAL FLOW
B12H	April 2010	PLT	27%	154.0	Horizontal	Homogeneous	348 755	Middle		BU TOO SHORT
B14H	February 2009	Production test	0%	12.0	Horizontal	Homogeneous	57 096	Middle		The reinterpretation is better
						Dual Poro	49 920	Na	Y	OK
B15H	January 2010	Production test	0%	59.0	Horizontal	Dual Poro	96 390	Low		NO RESERVOIR SIGNATURE

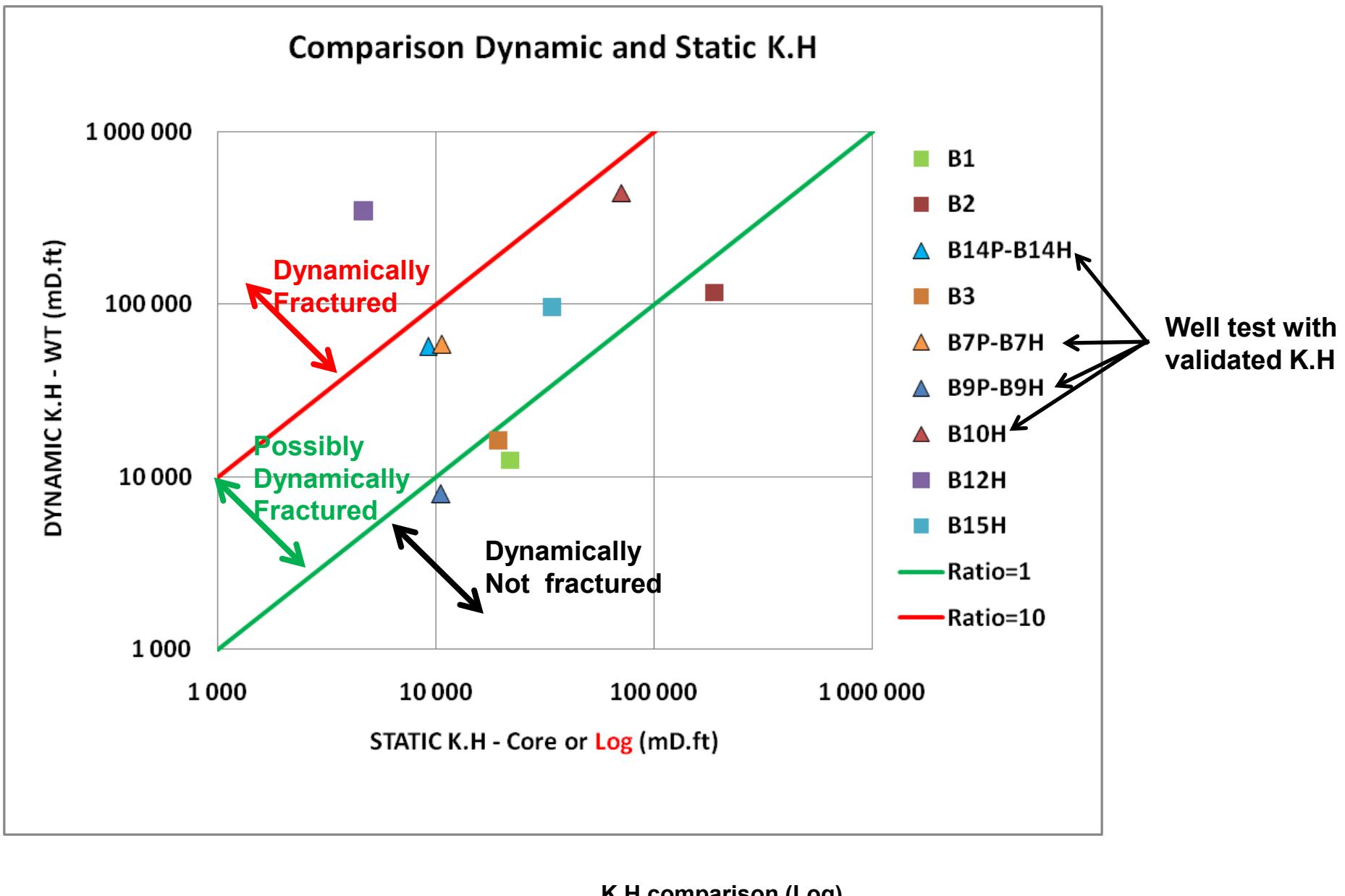


Fig. 5.62

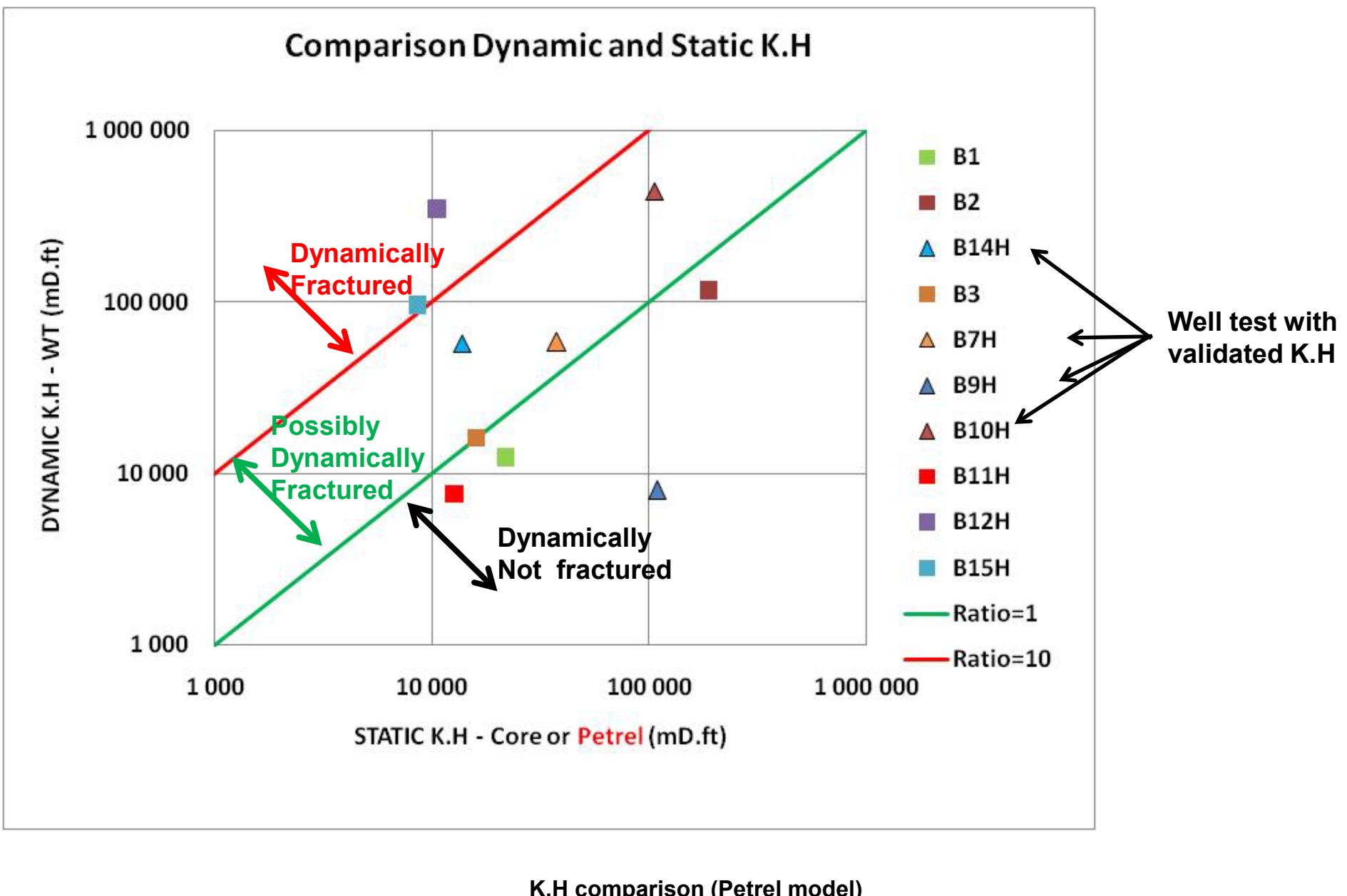
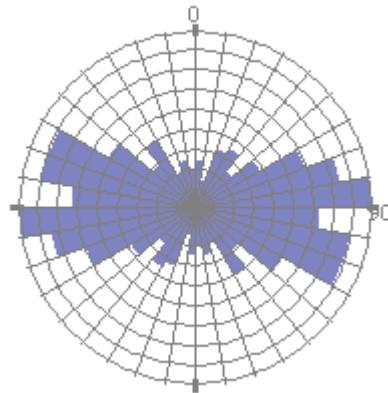
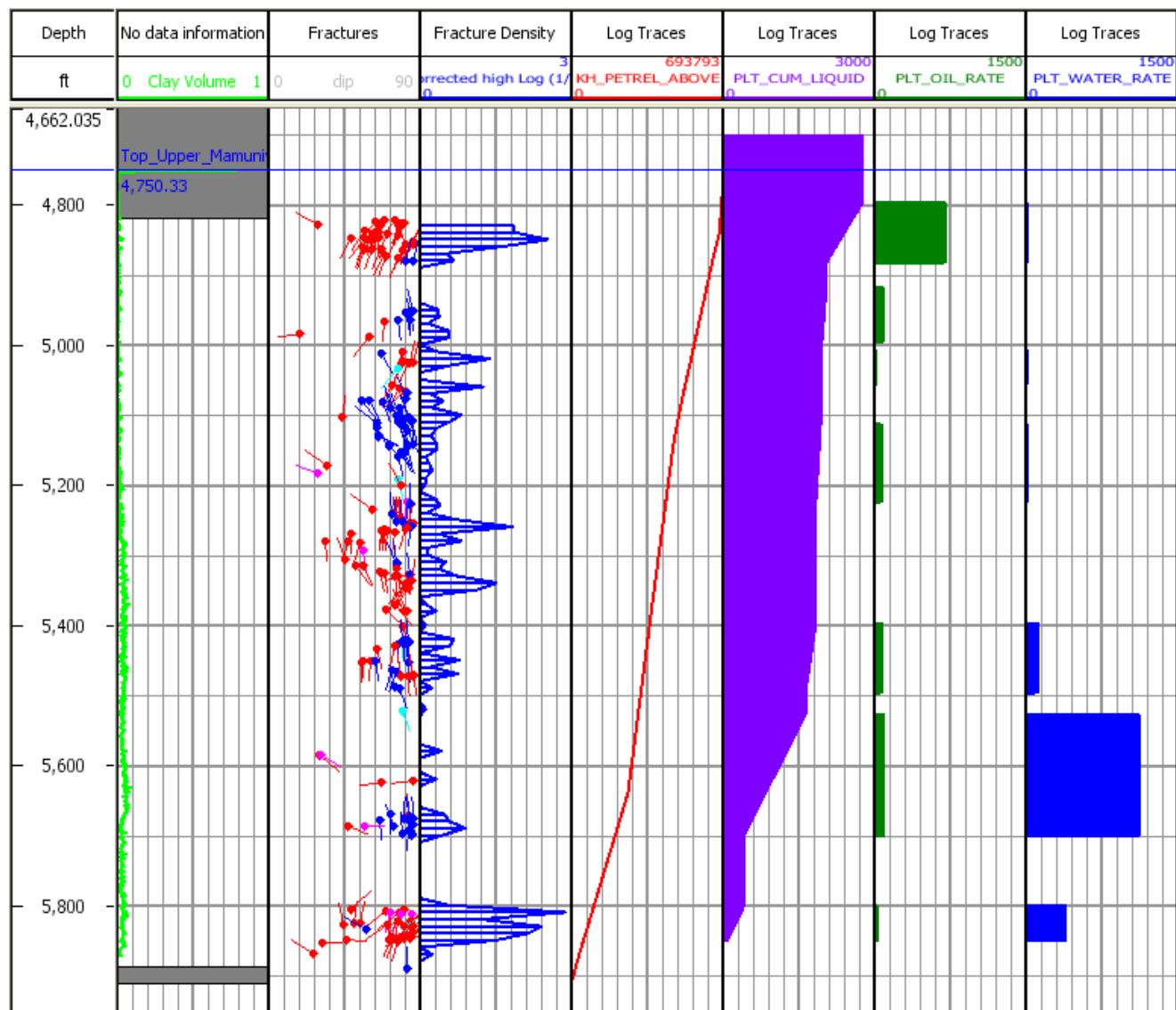


Fig. 5.63

CLUSTER
+
DIFFUSE



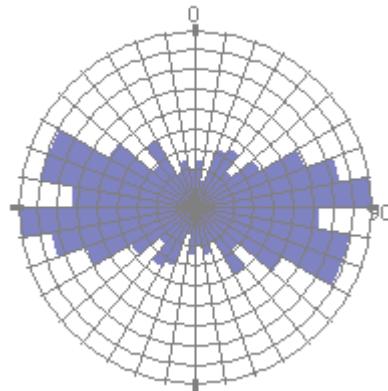
- Major_Conductive_Fracture ■
- Minor_Conductive_Fracture ◆
- Possible_Fault ▲
- Possible_Fracture ▼
- Resistive_Fracture ●



Windows size = 10 ft
Sampling = 10 ft

B6H – PLT, all interpreted fractures and cumulative static K.H

**CLUSTER
+
DIFFUSE**



- Major_Conductive_Fracture
- Minor_Conductive_Fracture
- Possible_Fault
- Possible_Fracture
- Resistive_Fracture

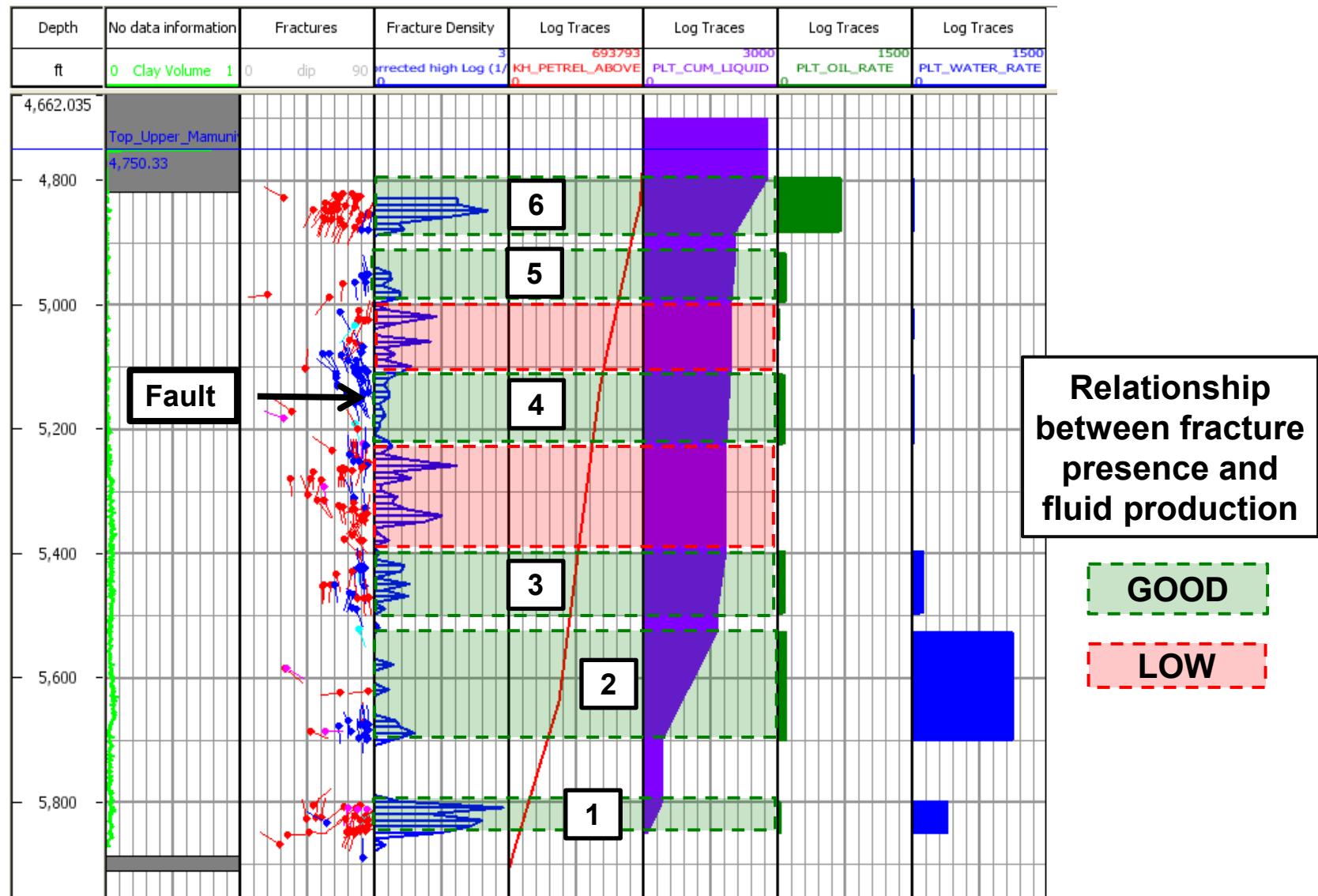
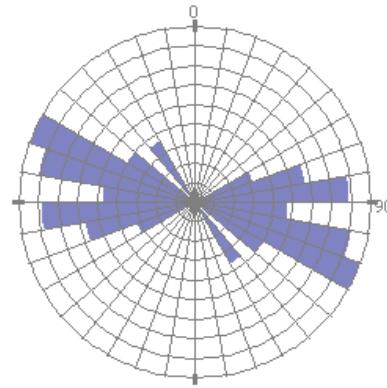
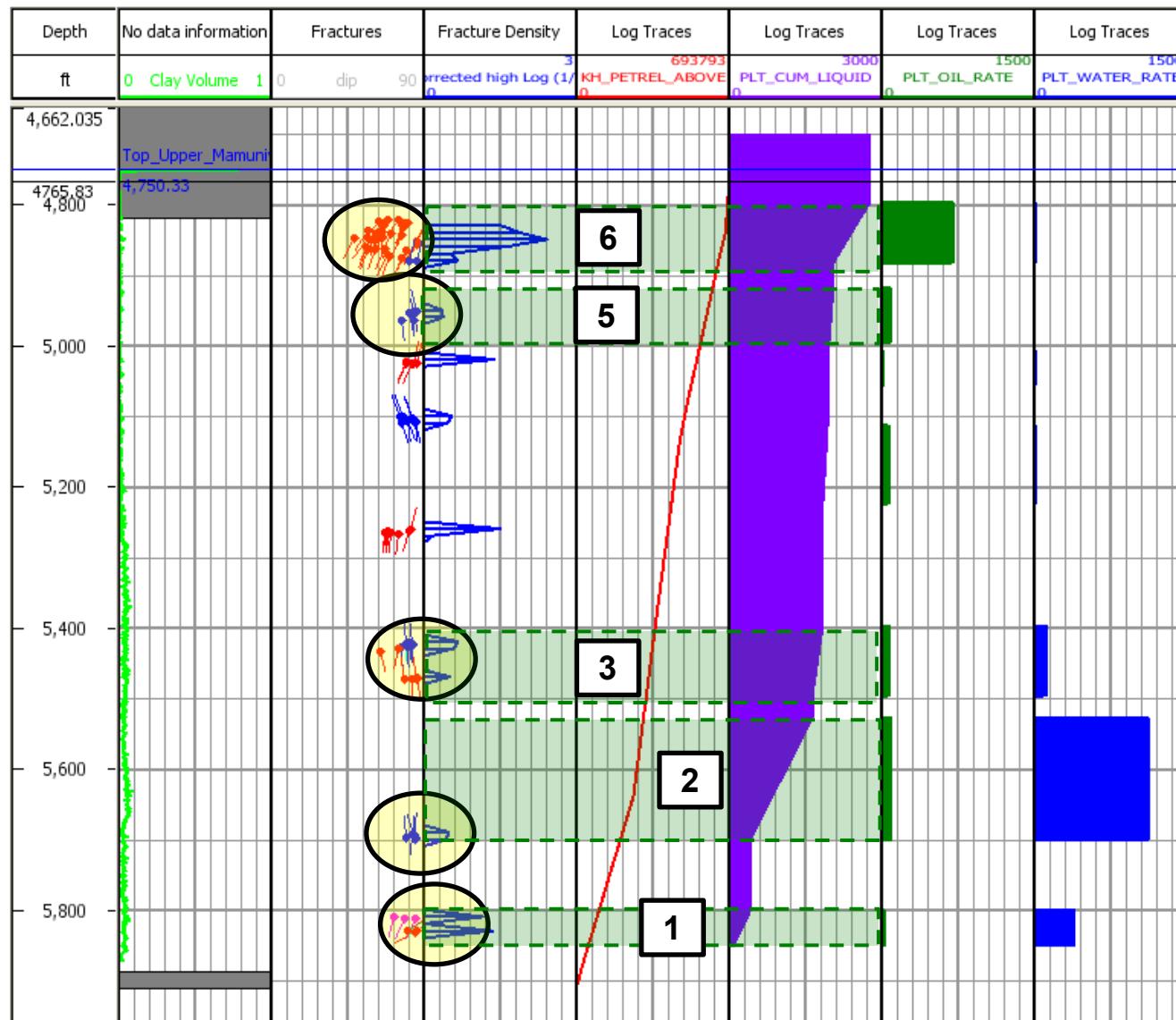


Fig. 5.65

B6H – Comparison of PLT with all interpreted fractures

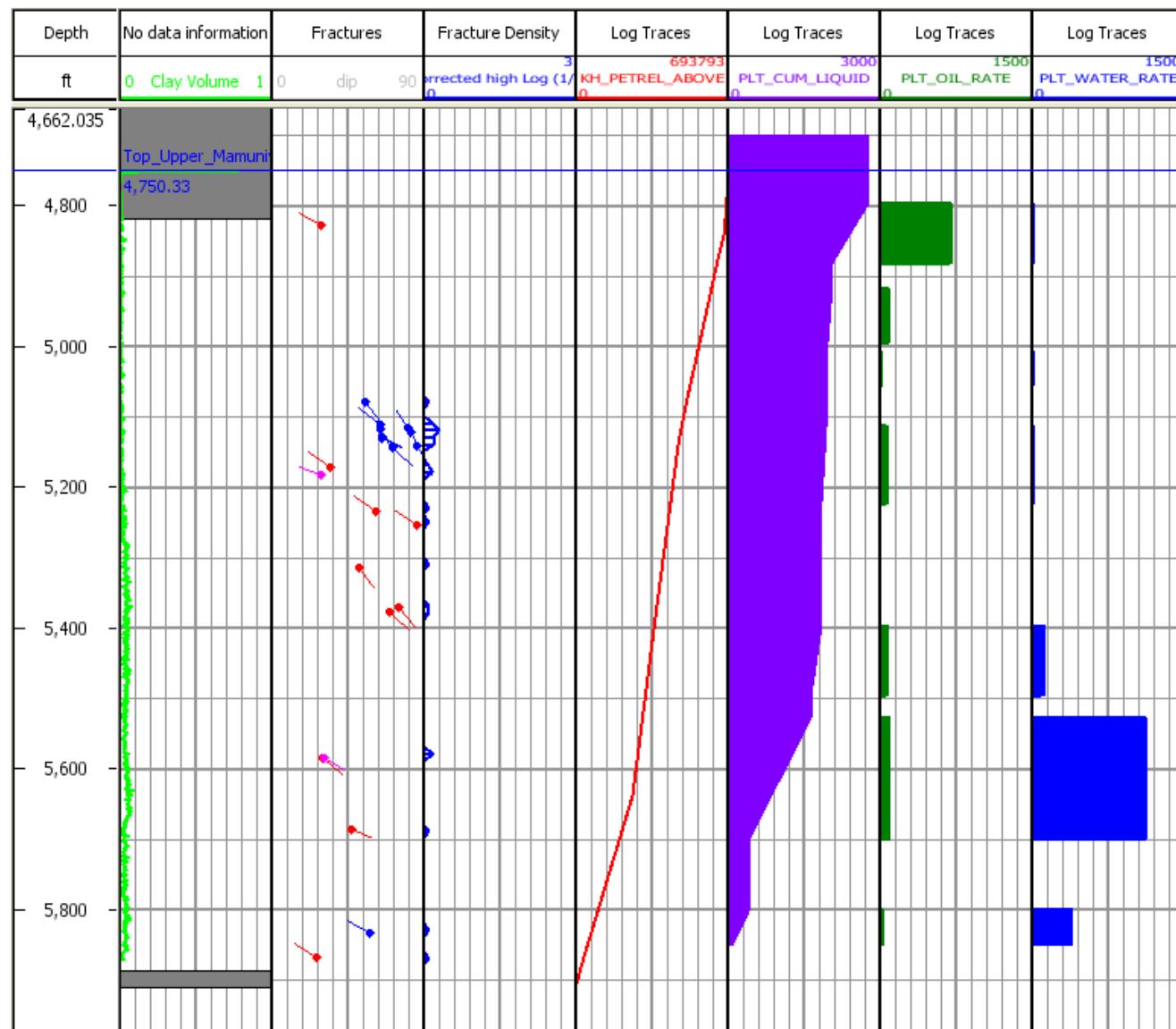
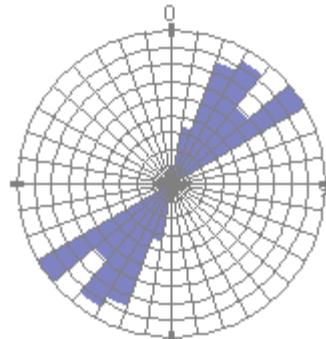
CLUSTER

- Major_Conductive_Fracture
- Minor_Conductive_Fracture
- Possible_Fault
- Possible_Fracture
- Resistive_Fracture



B6H – Comparison of PLT with fracture clusters only

**DIFFUSE
NE-SW**



B6H – Comparison of PLT with NE-SW diffuse fractures only

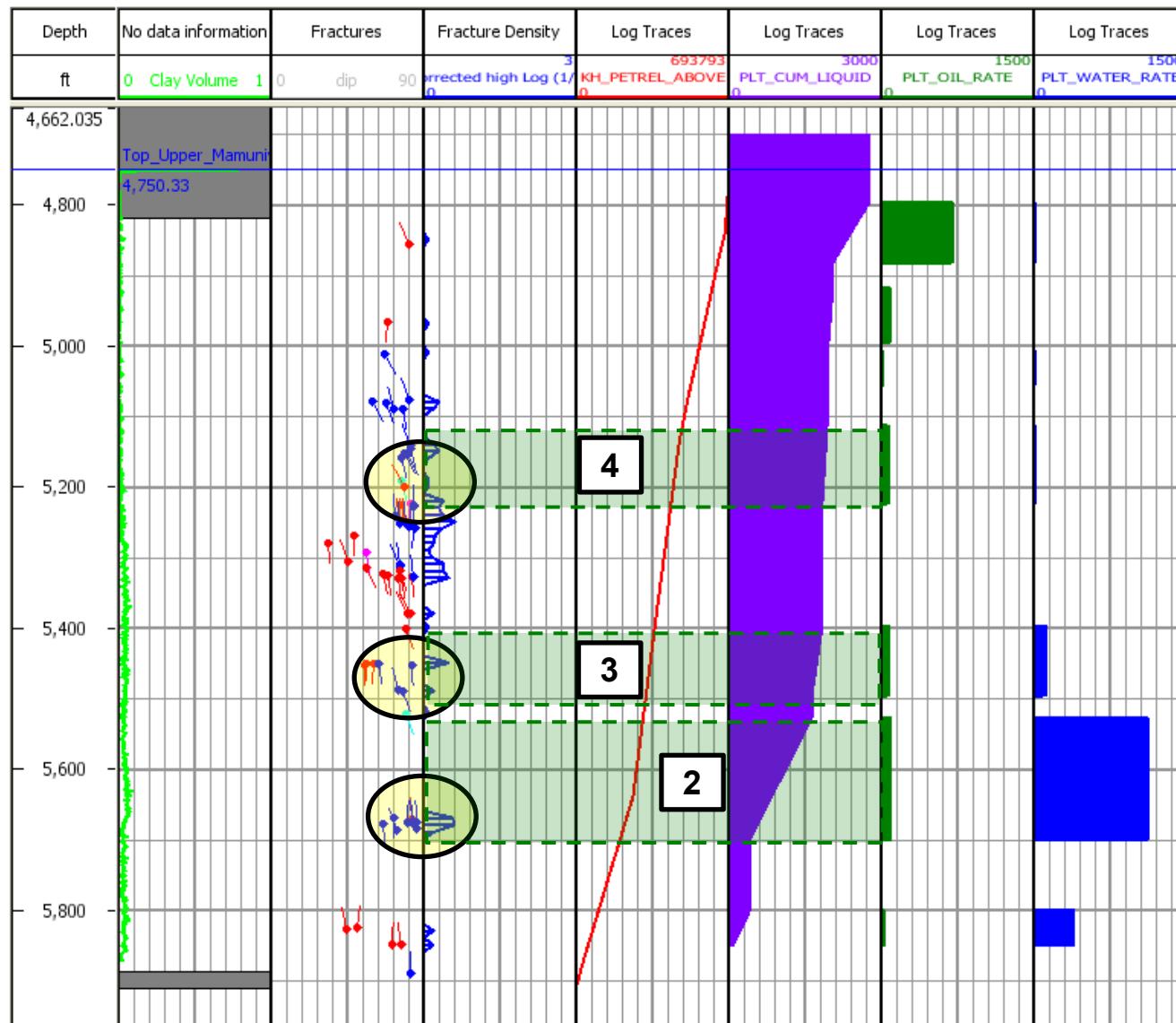


Fig. 5.68

B6H – Comparison of PLT with E-W diffuse fractures only

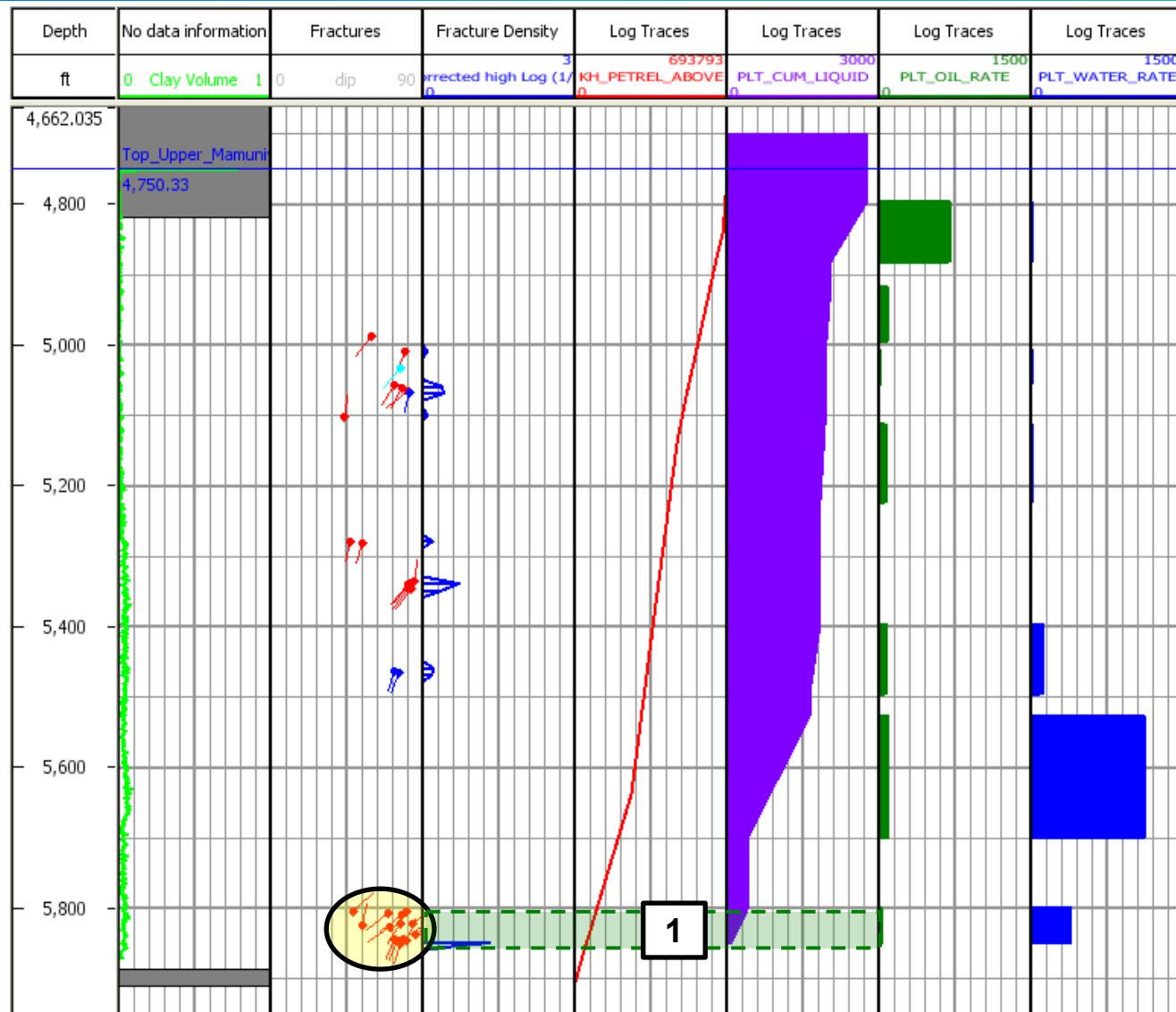
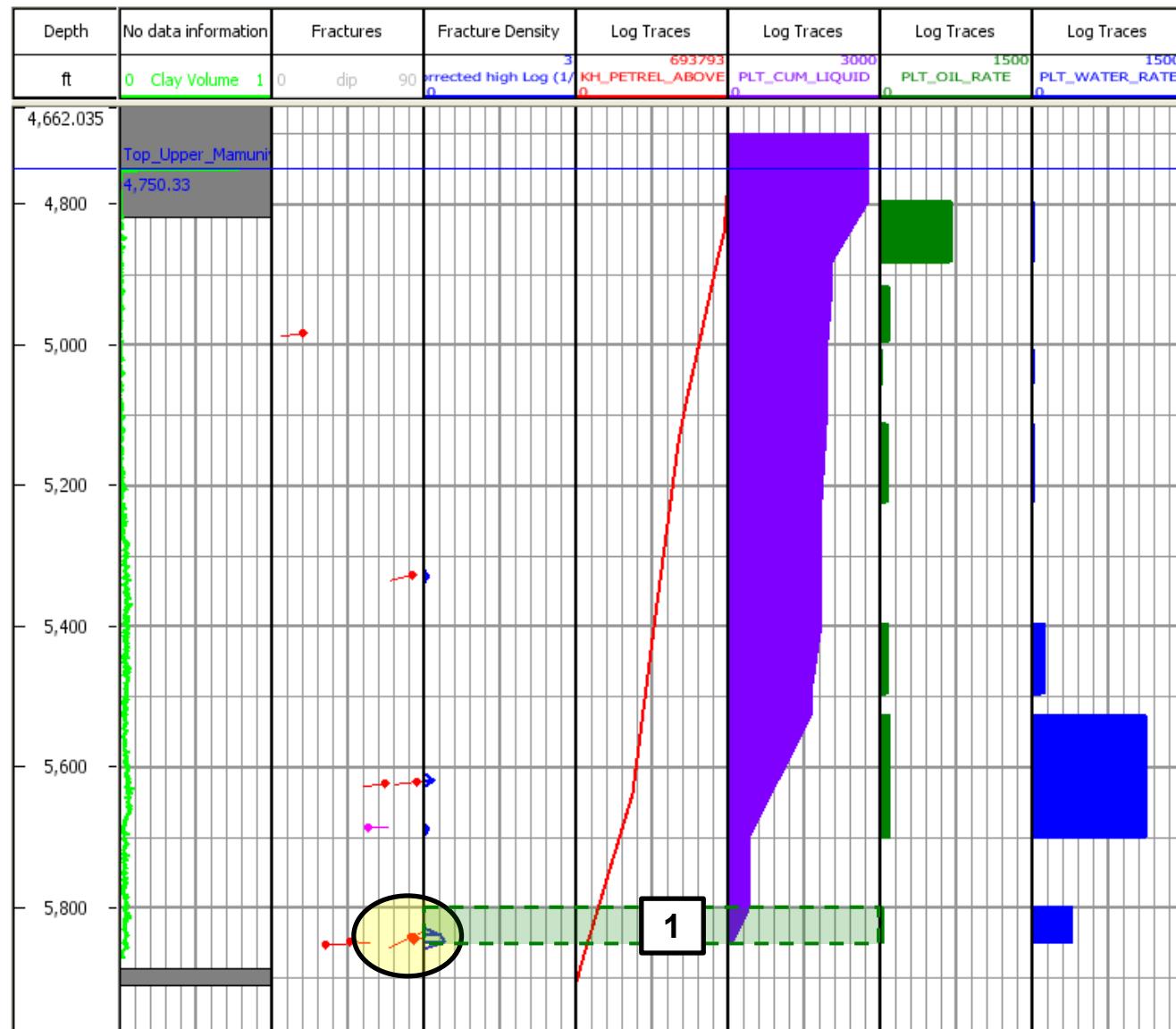


Fig. 5.69

B6H – Comparison of PLT with NW-SE diffuse fractures only



B6H – Comparison of PLT with N-S diffuse fractures only

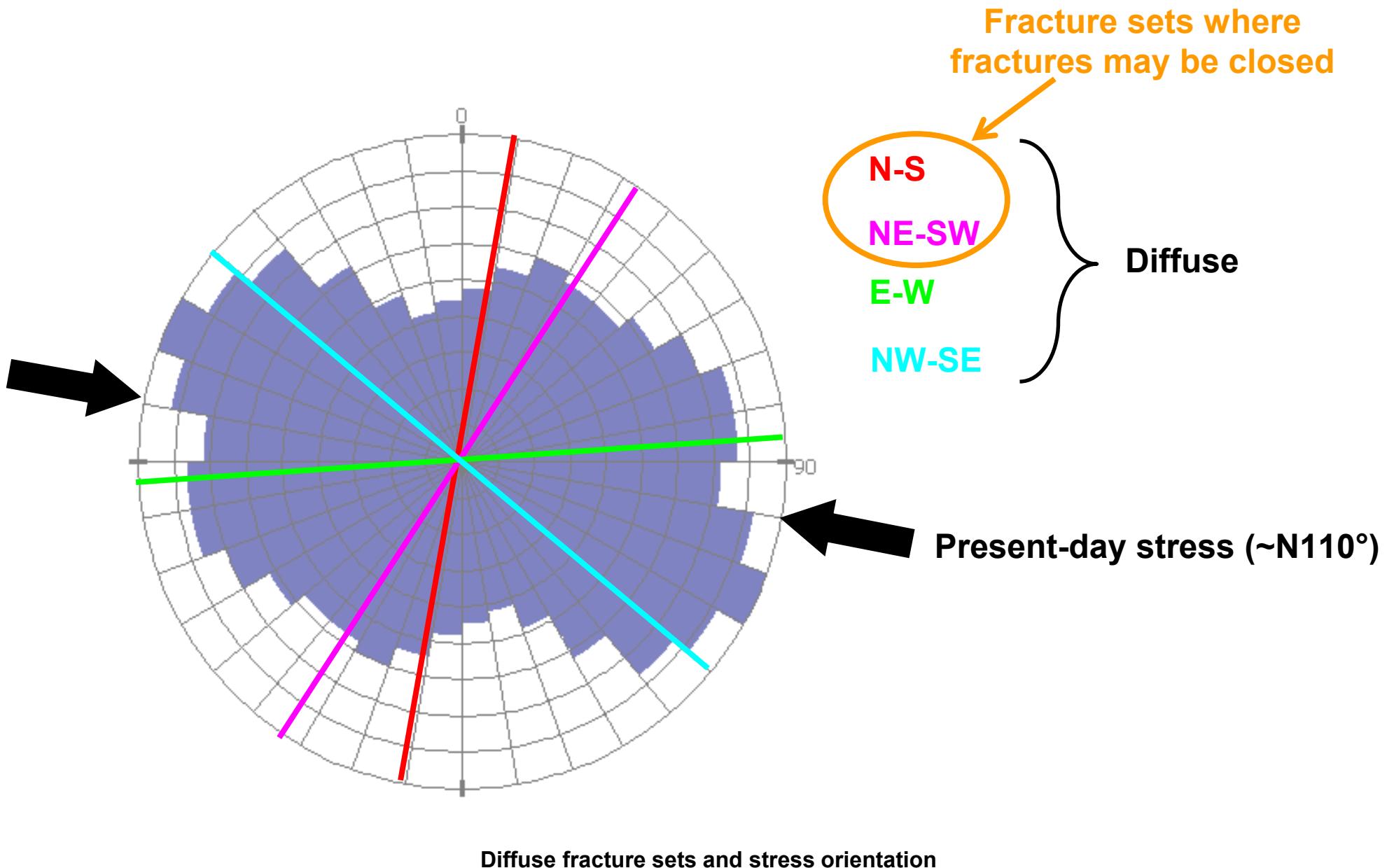


Fig. 5.71

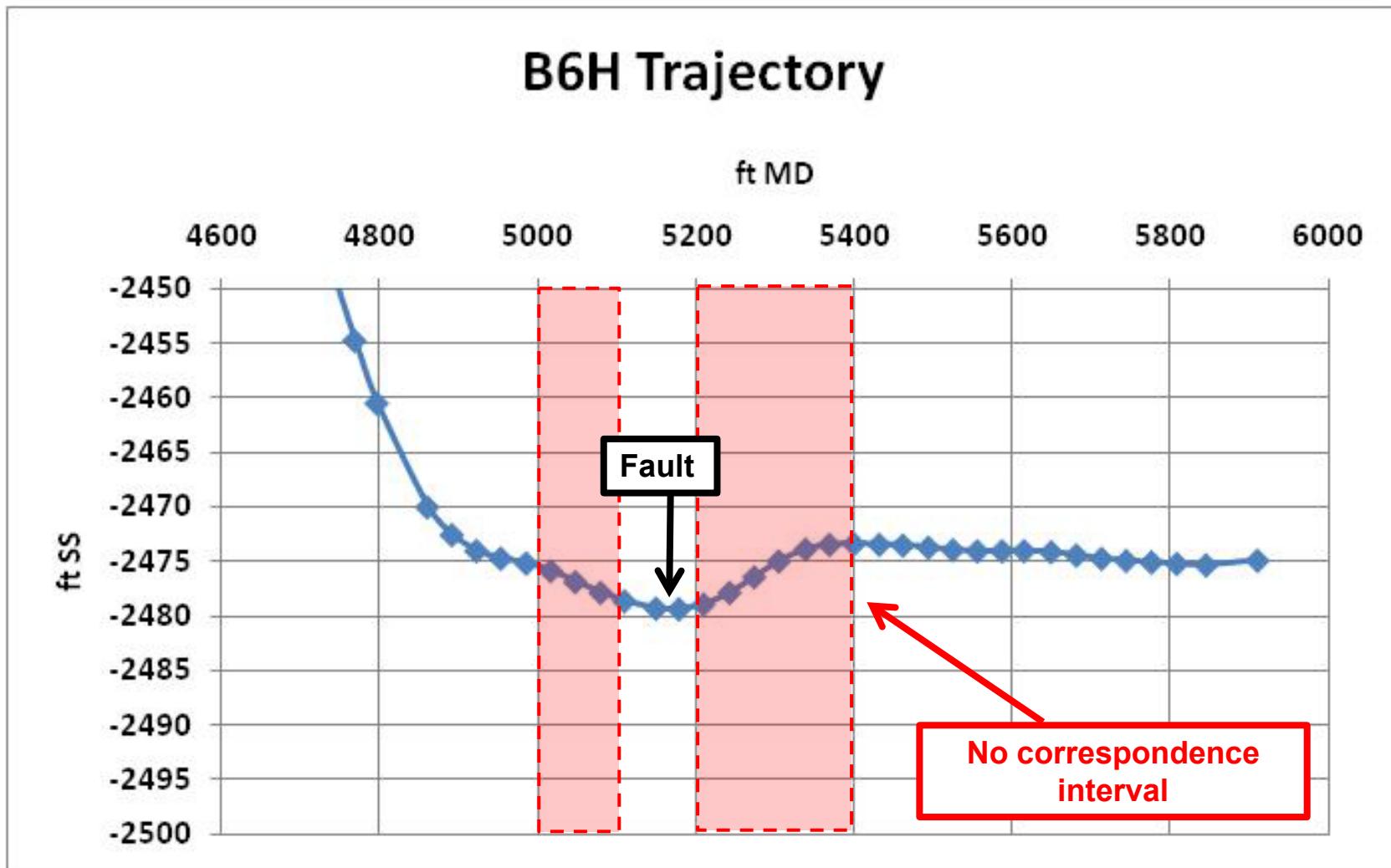
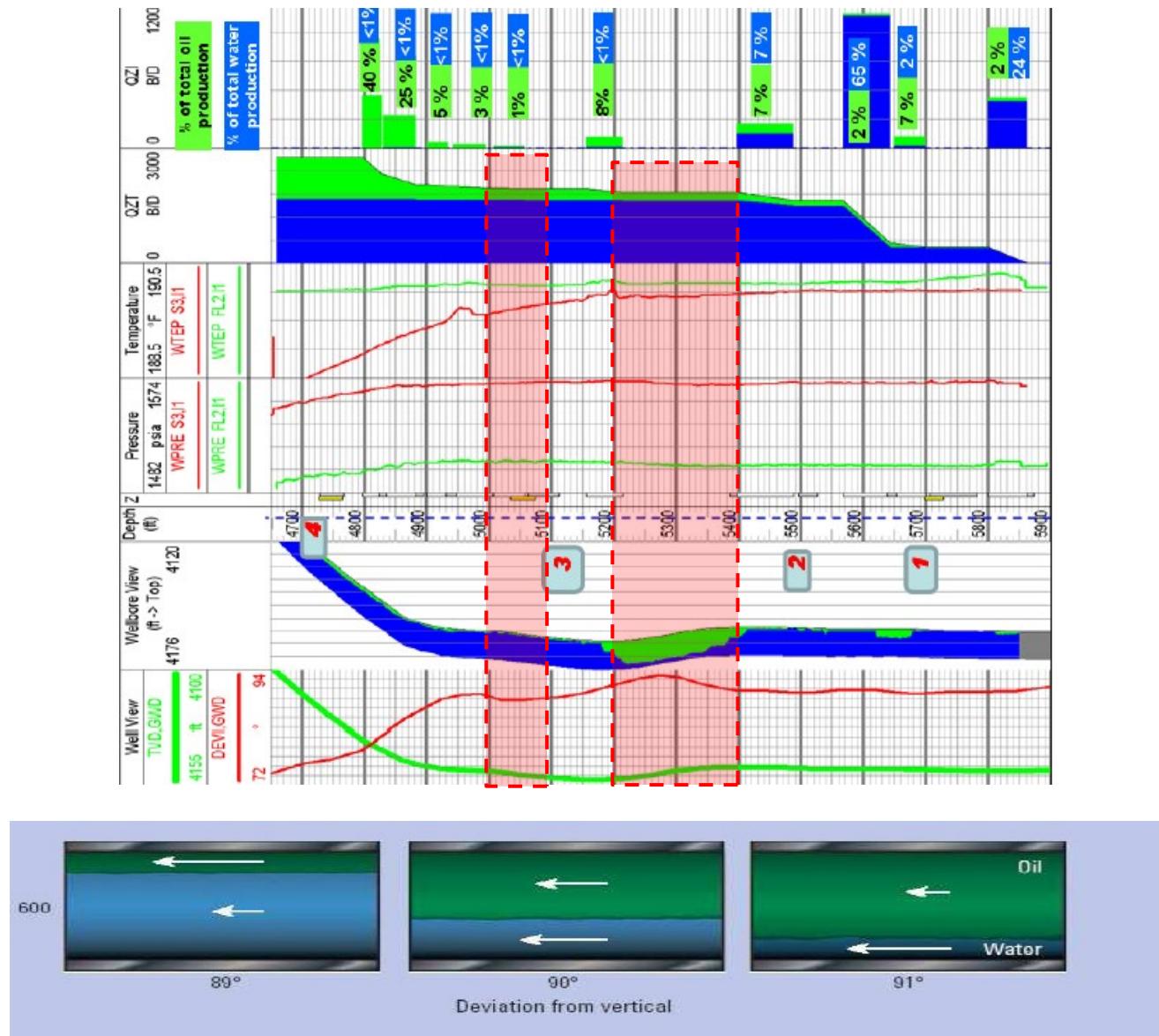


Fig. 5.72

B6H – Trajectory and intervals with no correspondence between fracture presence and fluid production



B6H – FSI

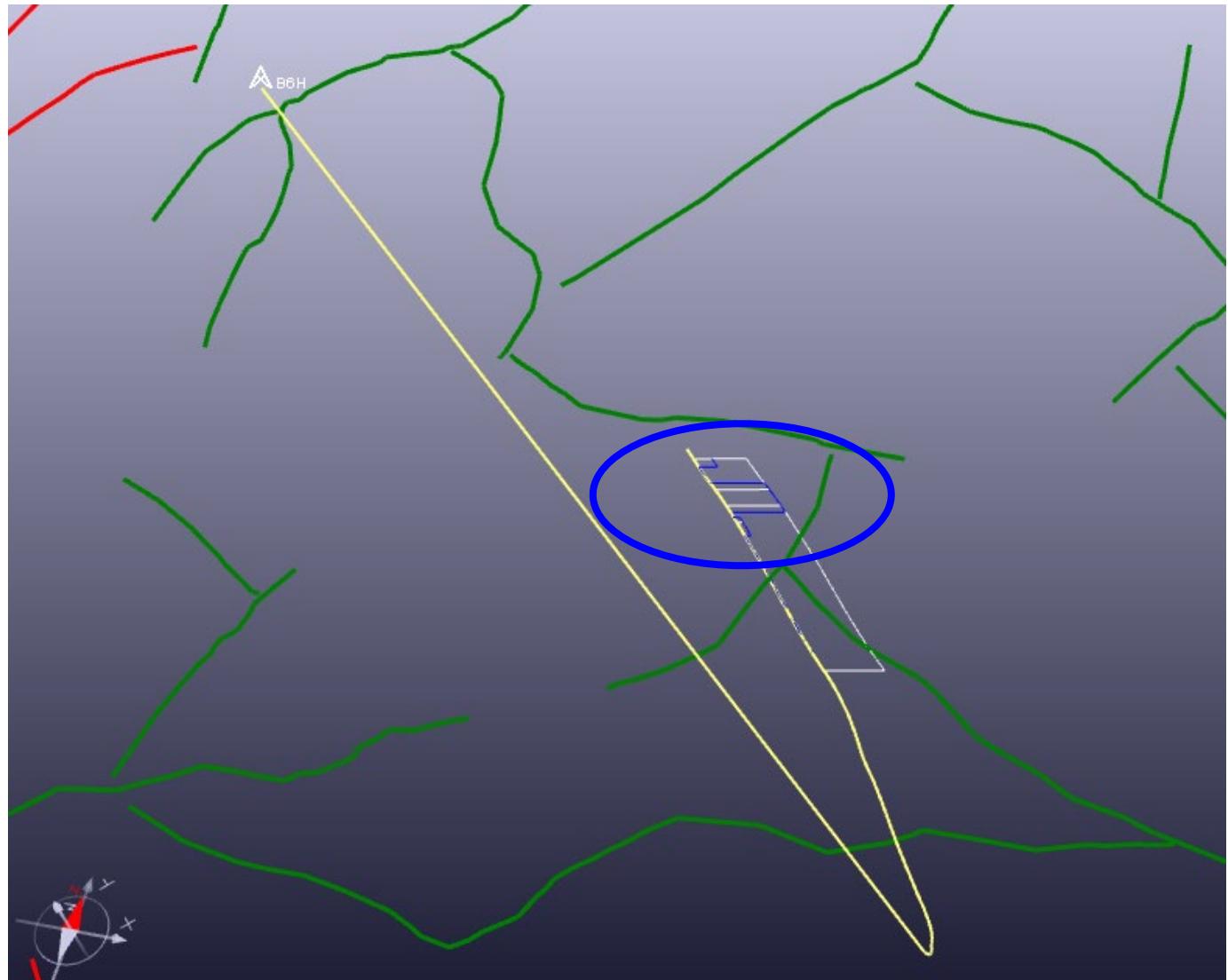
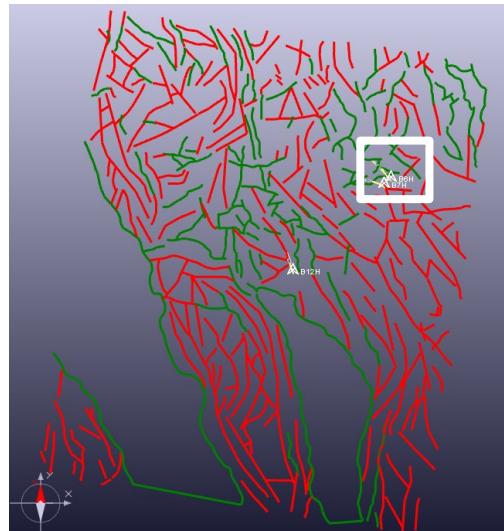
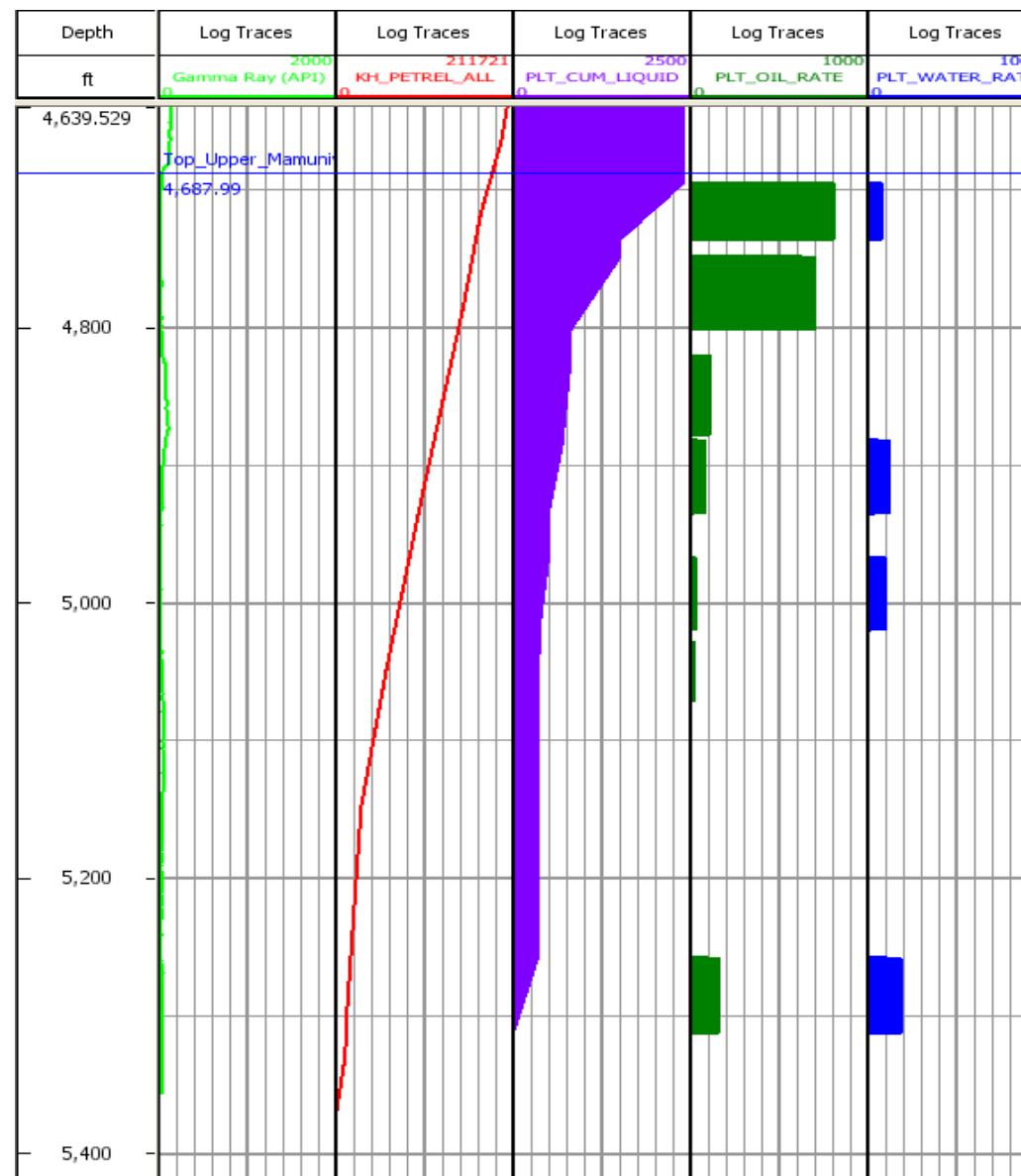


Fig. 5.74

NO
FRACTURE
DATA



B7H – PLT and cumulative static K.H

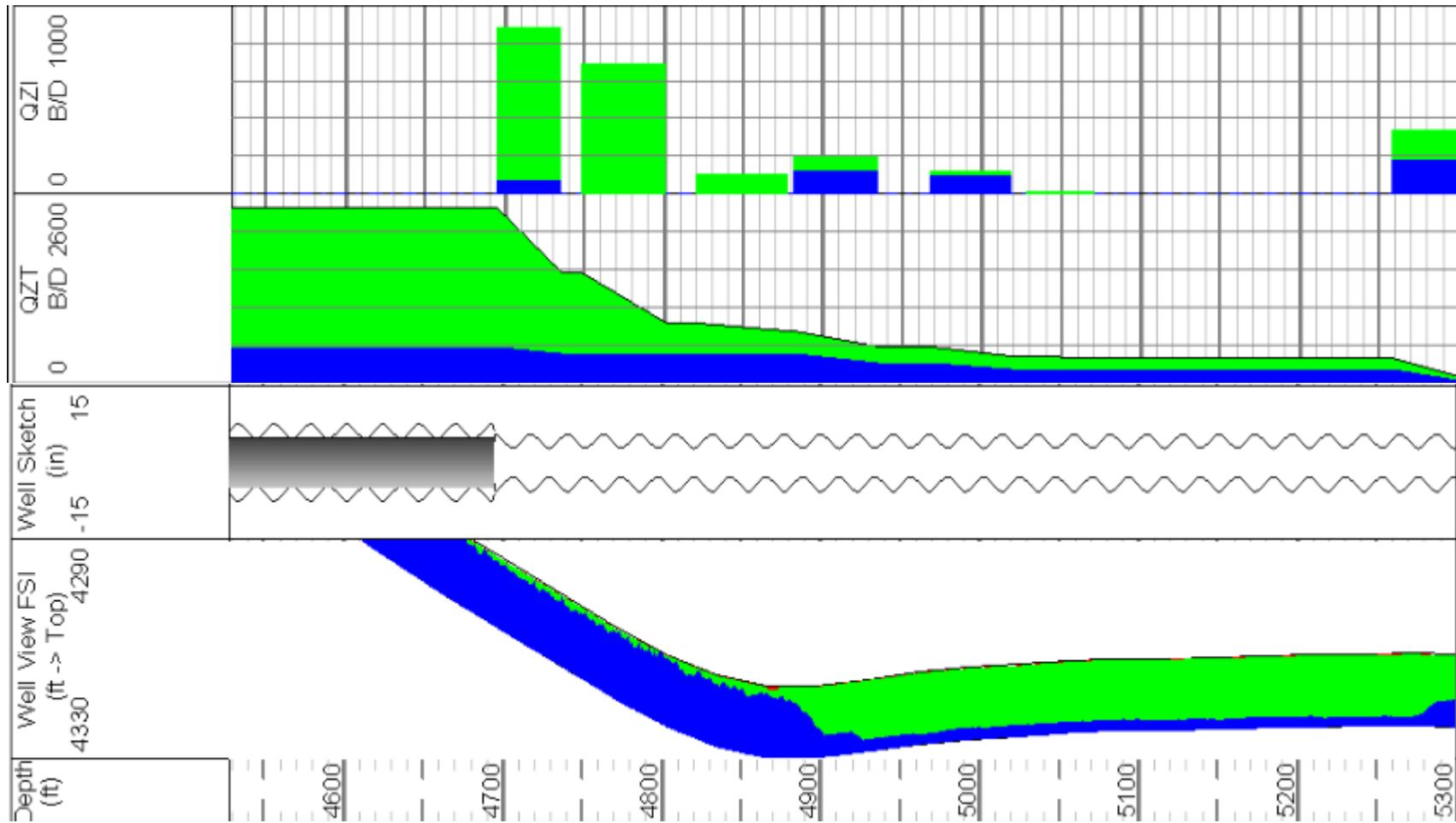
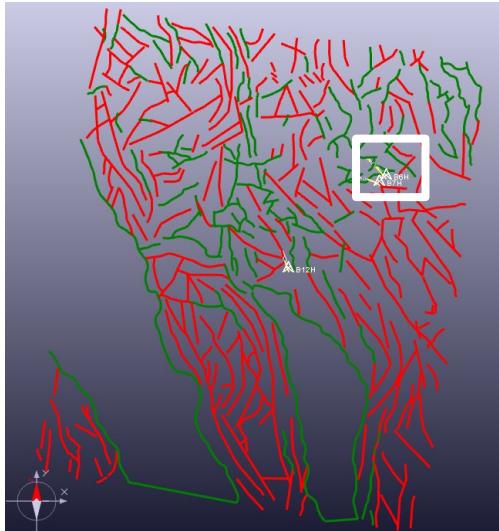


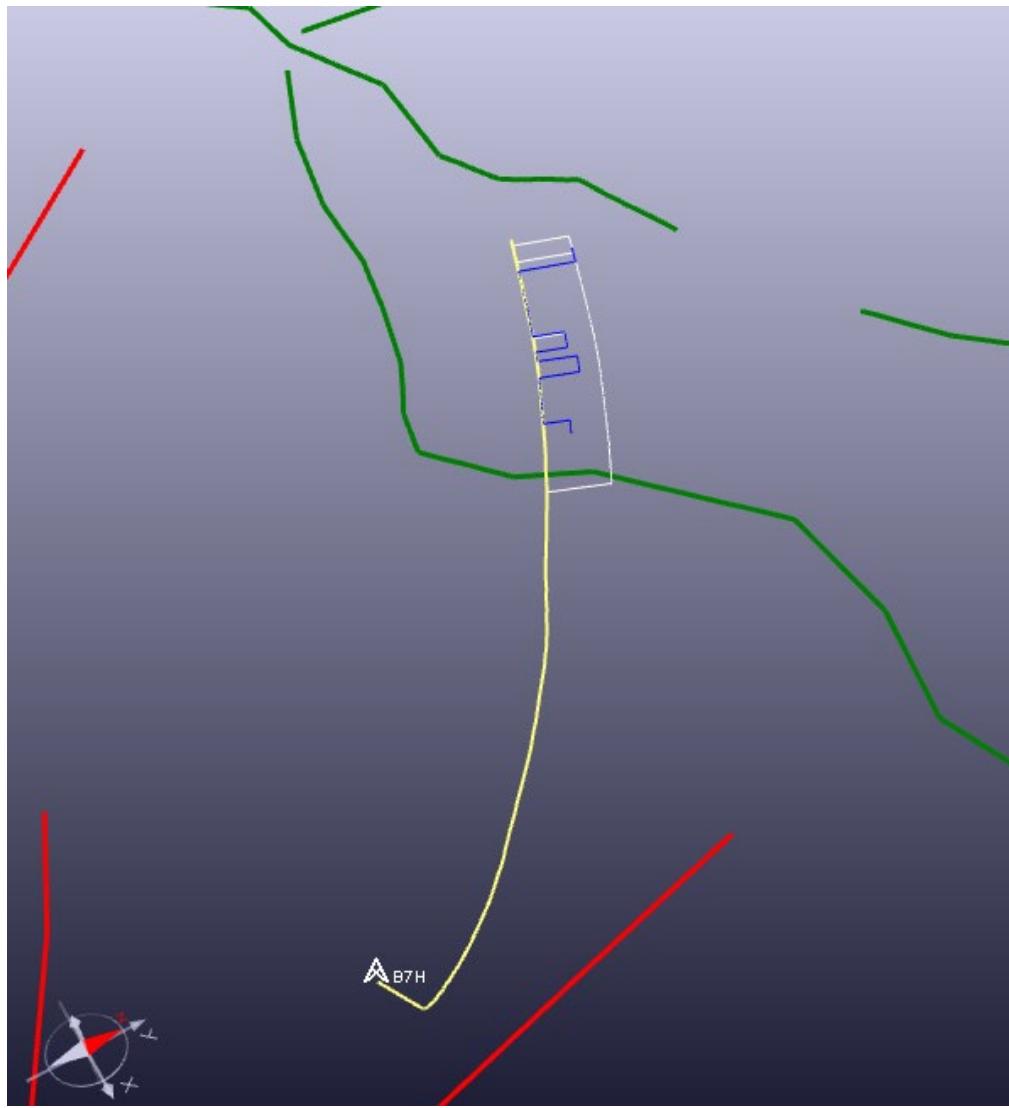
Fig. 5.76

B7H – FSI



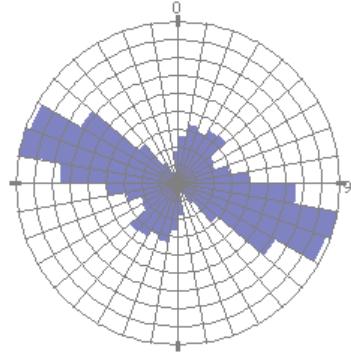
FAULTS

LINEAMENTS



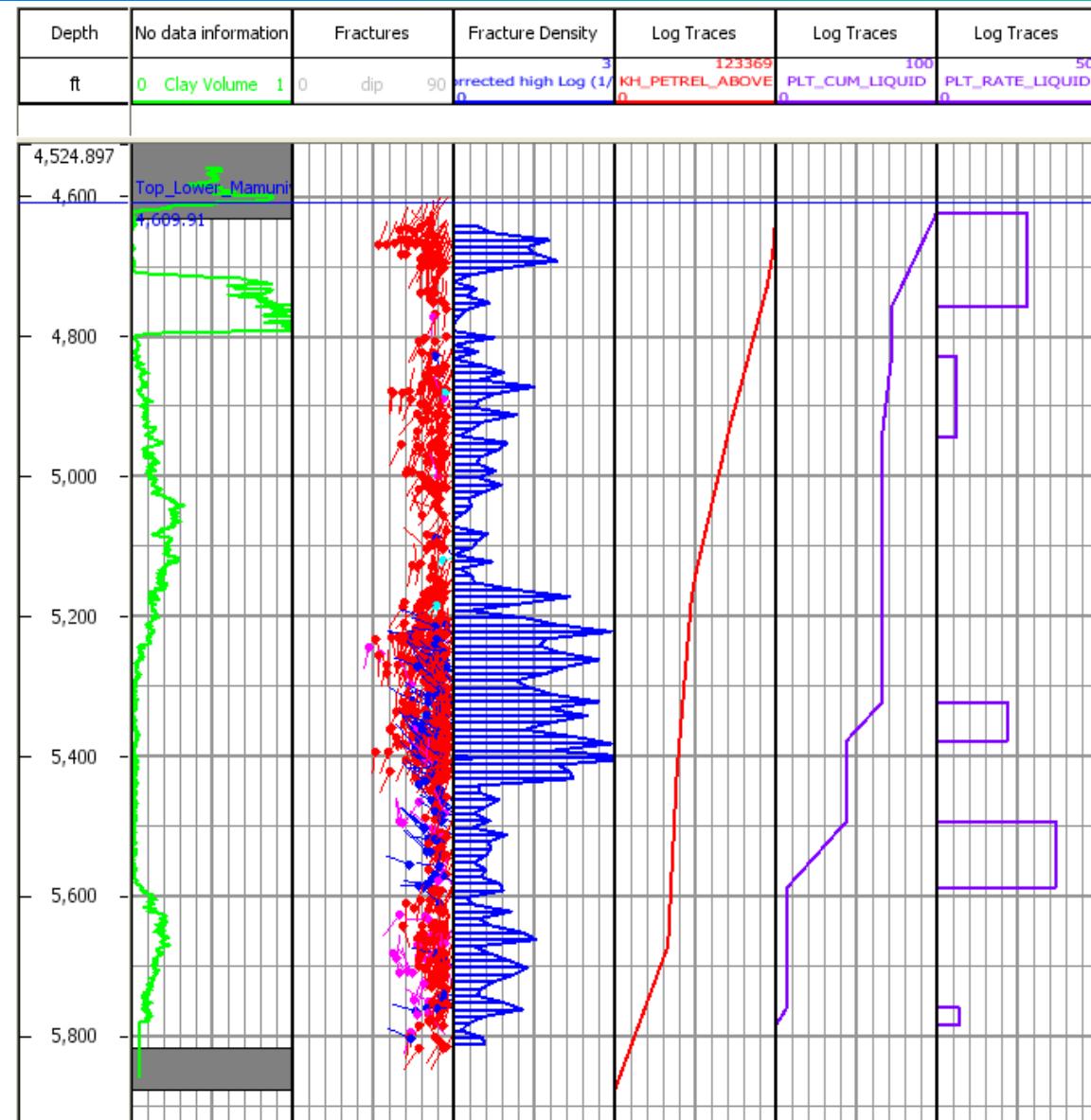
B7H – Water production in PLT and structural objects (3D view)

**CLUSTER
+
DIFFUSE**



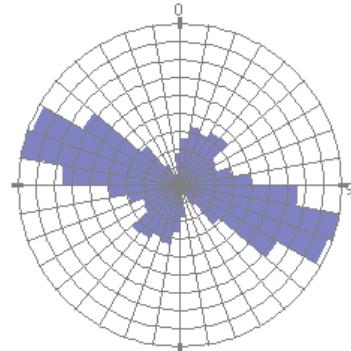
- Major_Conductive_Fracture ■
- Minor_Conductive_Fracture ◆
- Possible_Fault ○
- Possible_Fracture ▲
- Resistive_Fracture ●

**Windows size = 10 ft
Sampling = 10 ft**



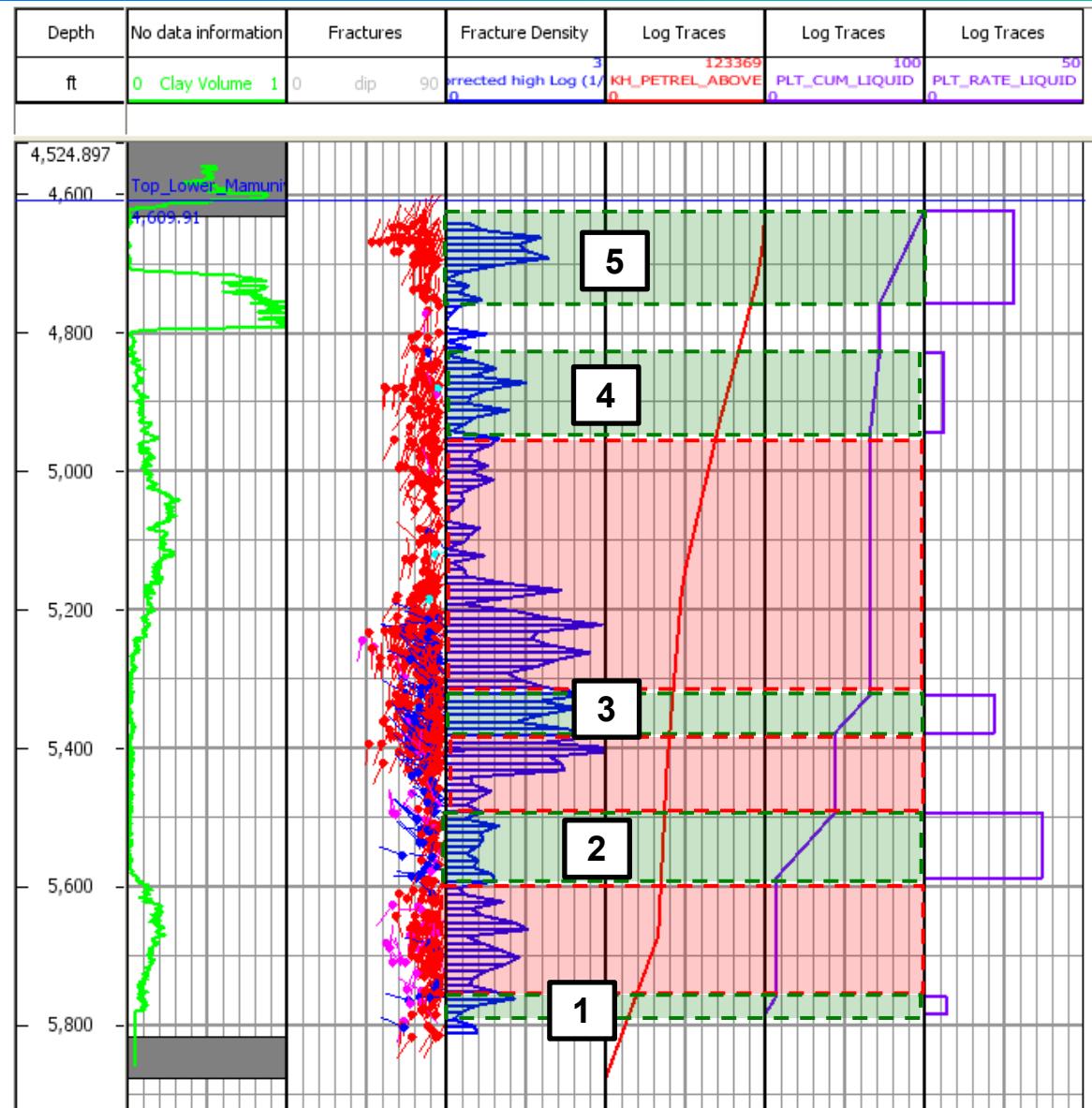
B11H – PLT, all interpreted fractures and cumulative static K.H

CLUSTER
+
DIFFUSE



- Major_Conductive_Fracture ■
- Minor_Conductive_Fracture ◆
- Possible_Fault ▲
- Possible_Fracture ▼
- Resistive_Fracture ●

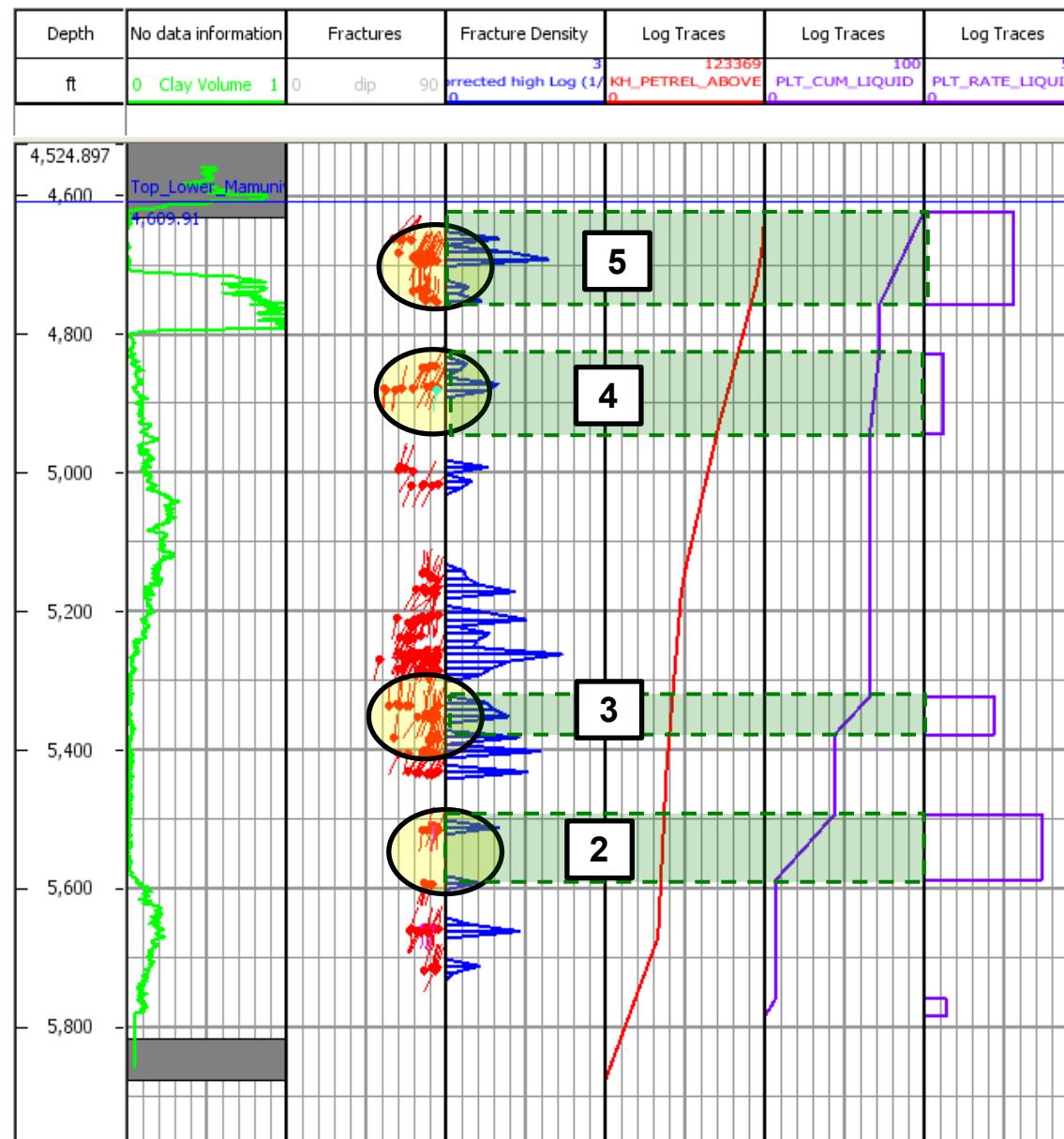
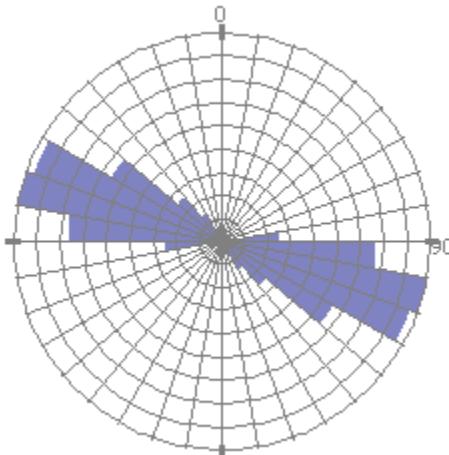
Windows size = 10 ft
Sampling = 10 ft



**Relationship
between fracture
presence and
fluid production**

GOOD

LOW

CLUSTER**B11H – Comparison of PLT with fracture clusters only**

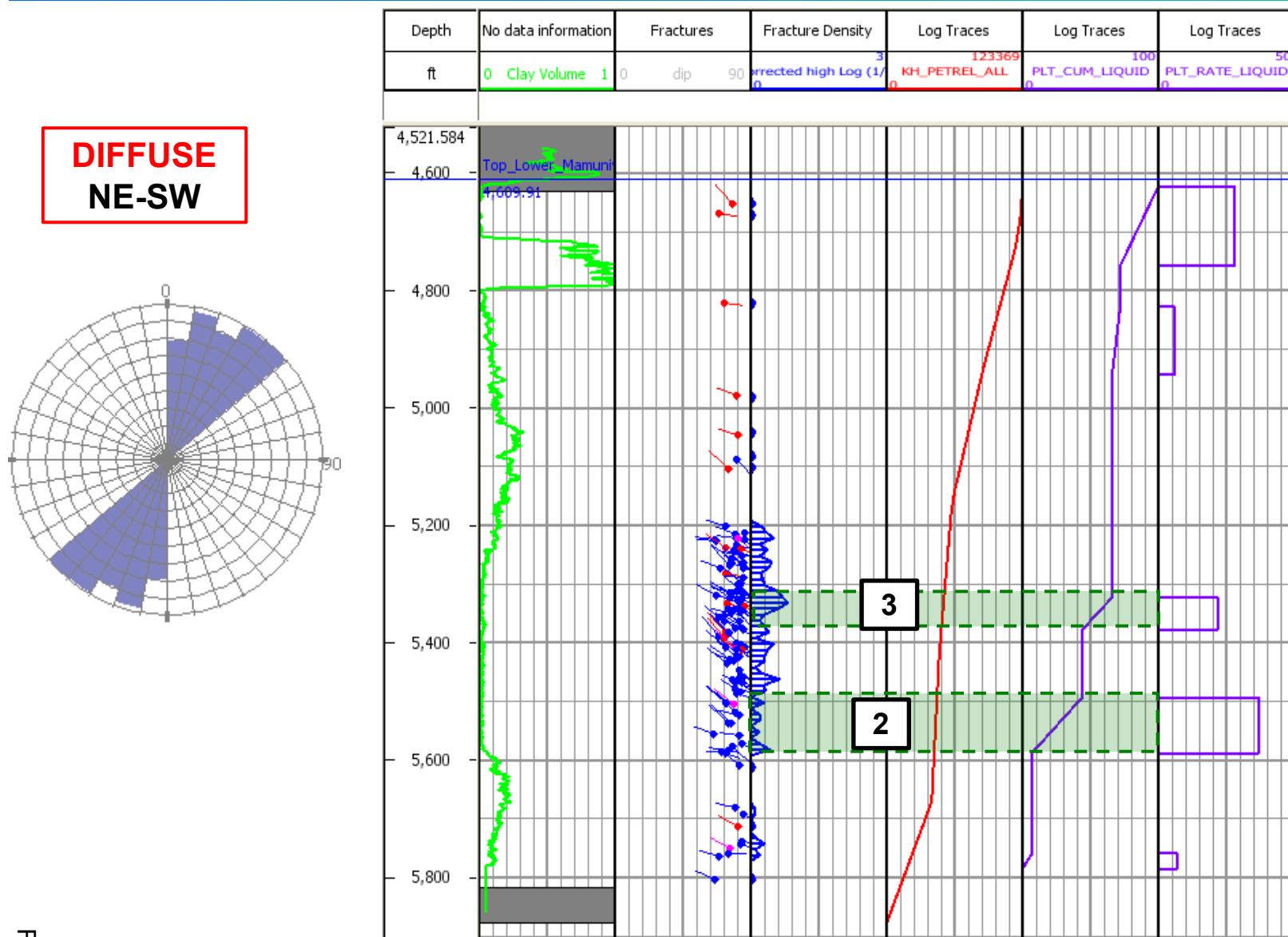


Fig. 5.81

B11H – Comparison of PLT with NE-SW diffuse fractures only

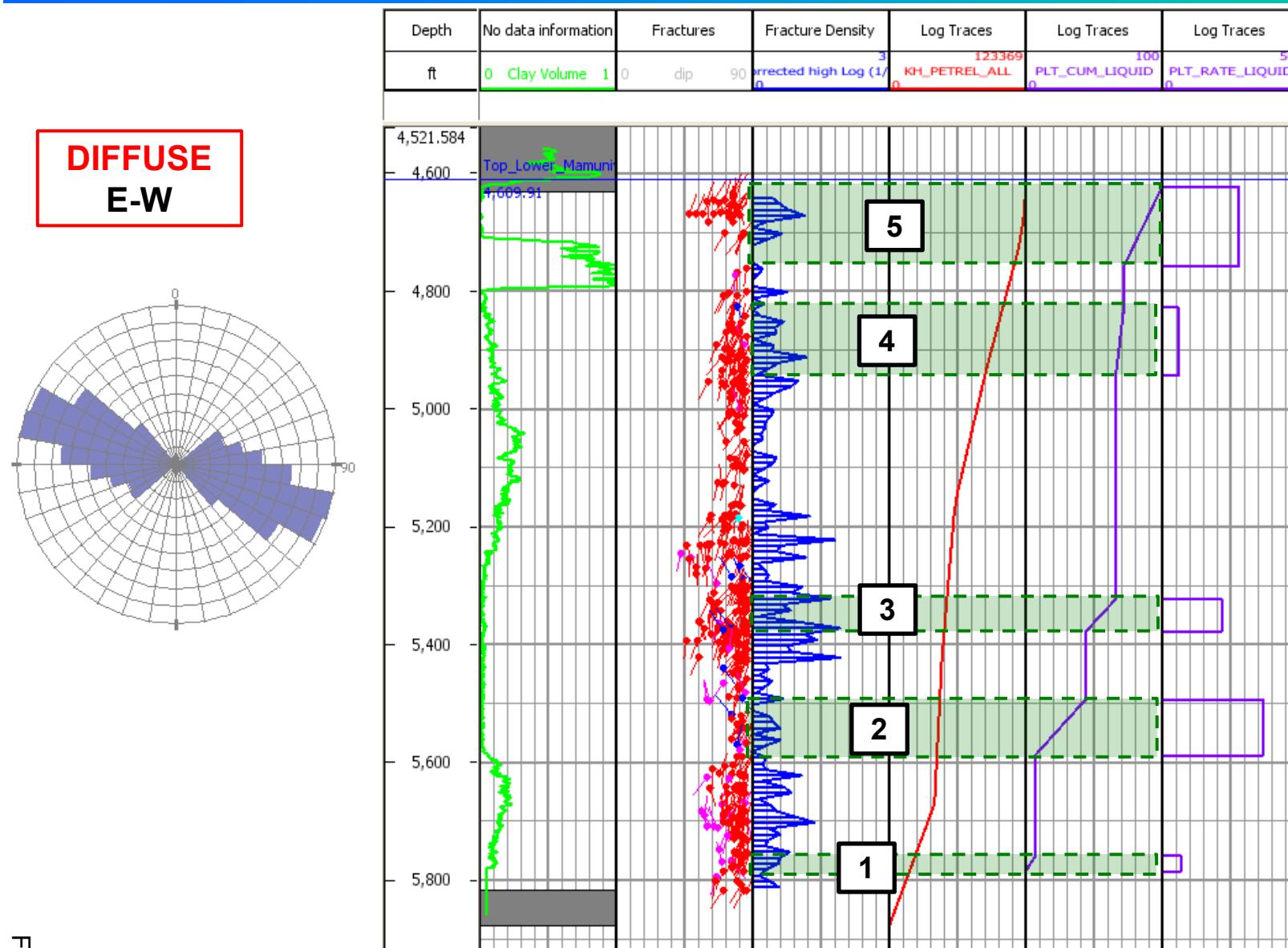
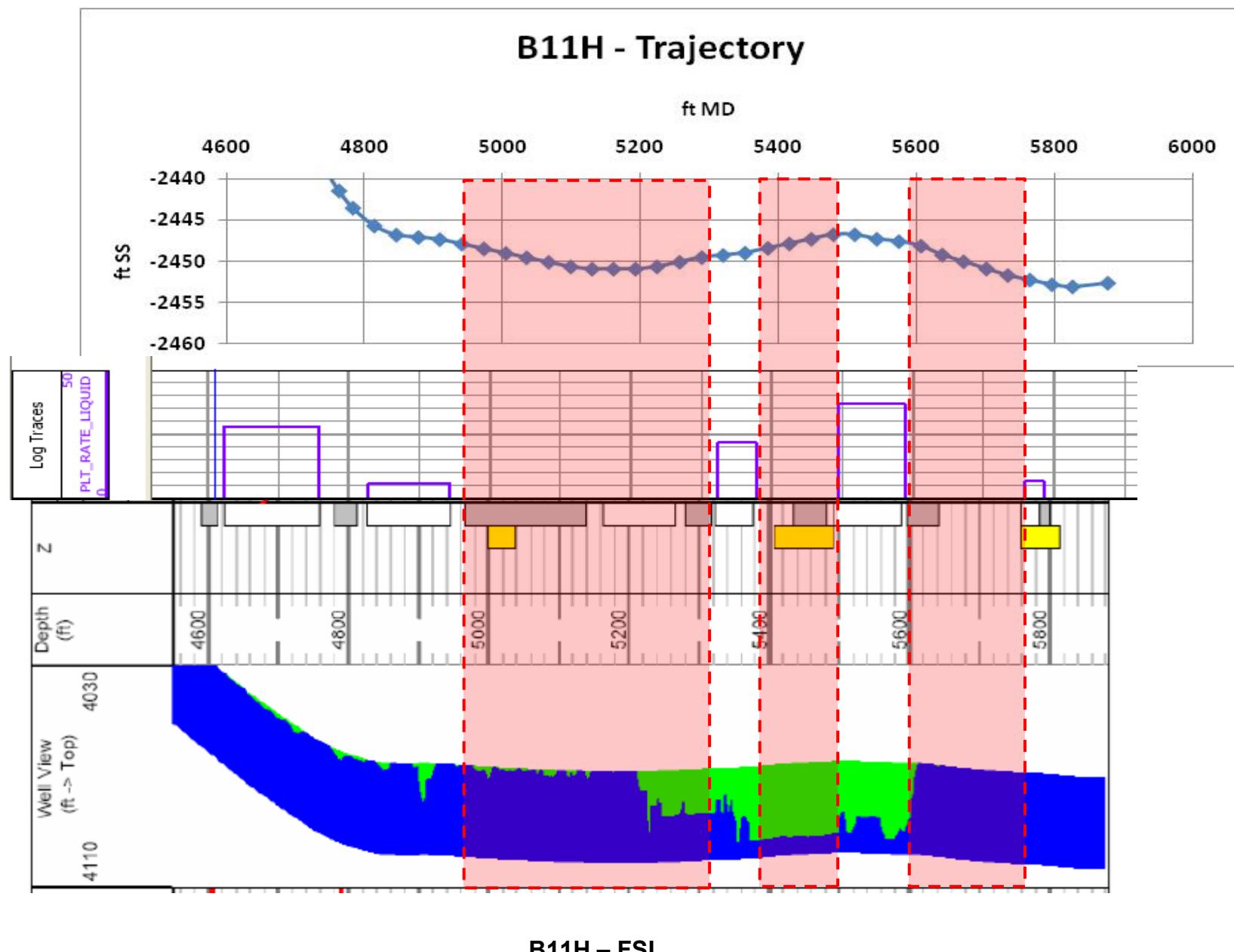
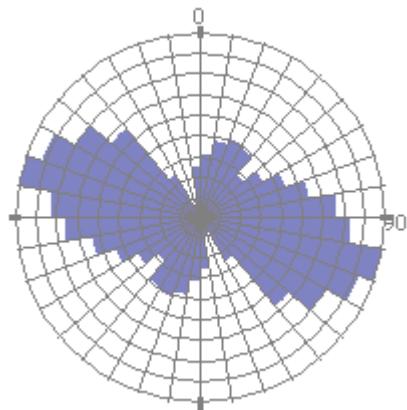


Fig. 5.82

B11H – Comparison of PLT with E-W diffuse fractures only

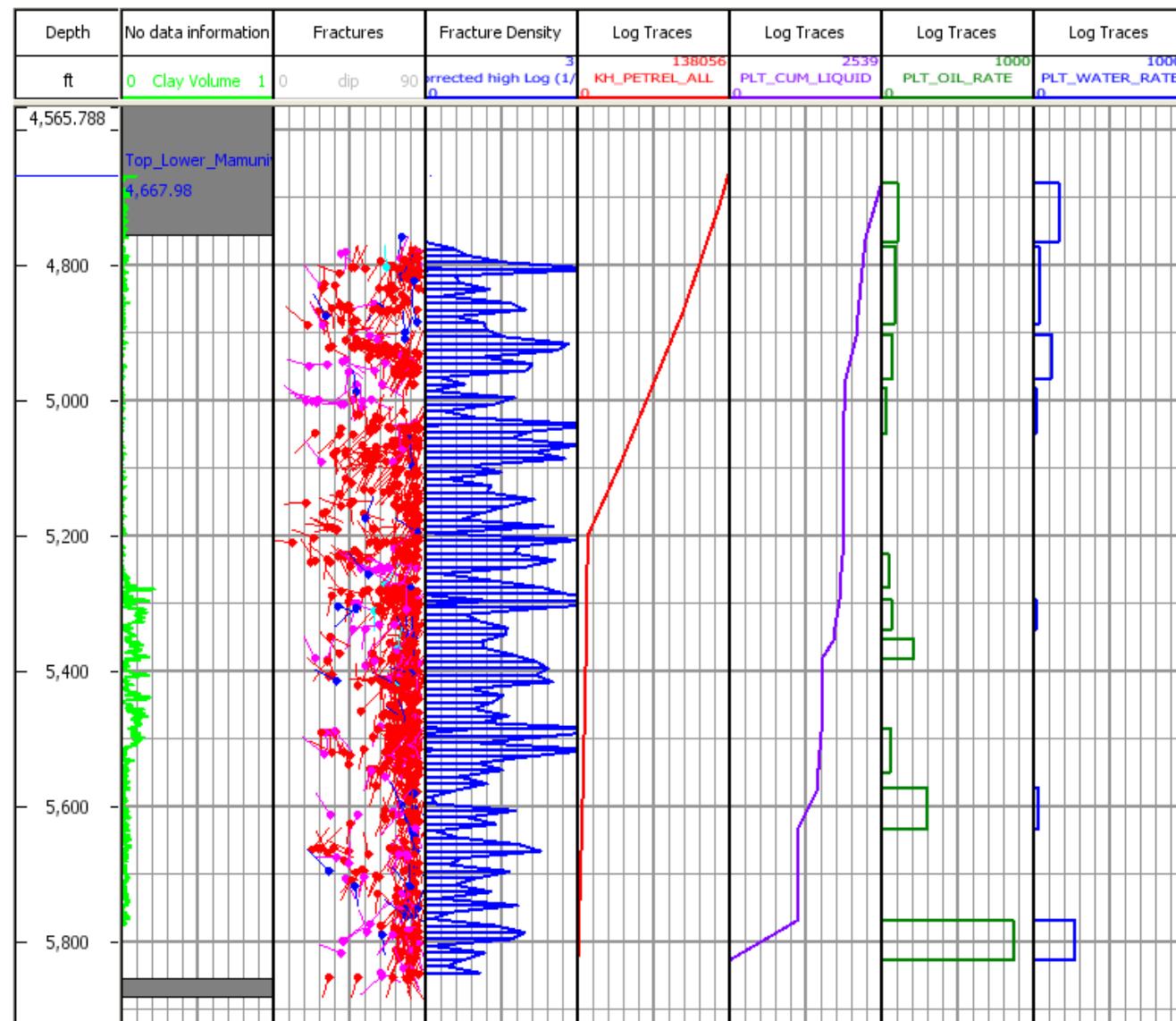


CLUSTER
+
DIFFUSE



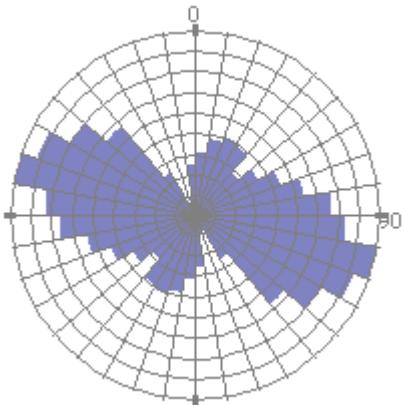
- Major_Conductive_Fracture ■
- Minor_Conductive_Fracture ◆
- Possible_Fault ○
- Possible_Fracture ▲
- Resistive_Fracture ●

Windows size = 10 ft
Sampling = 10 ft



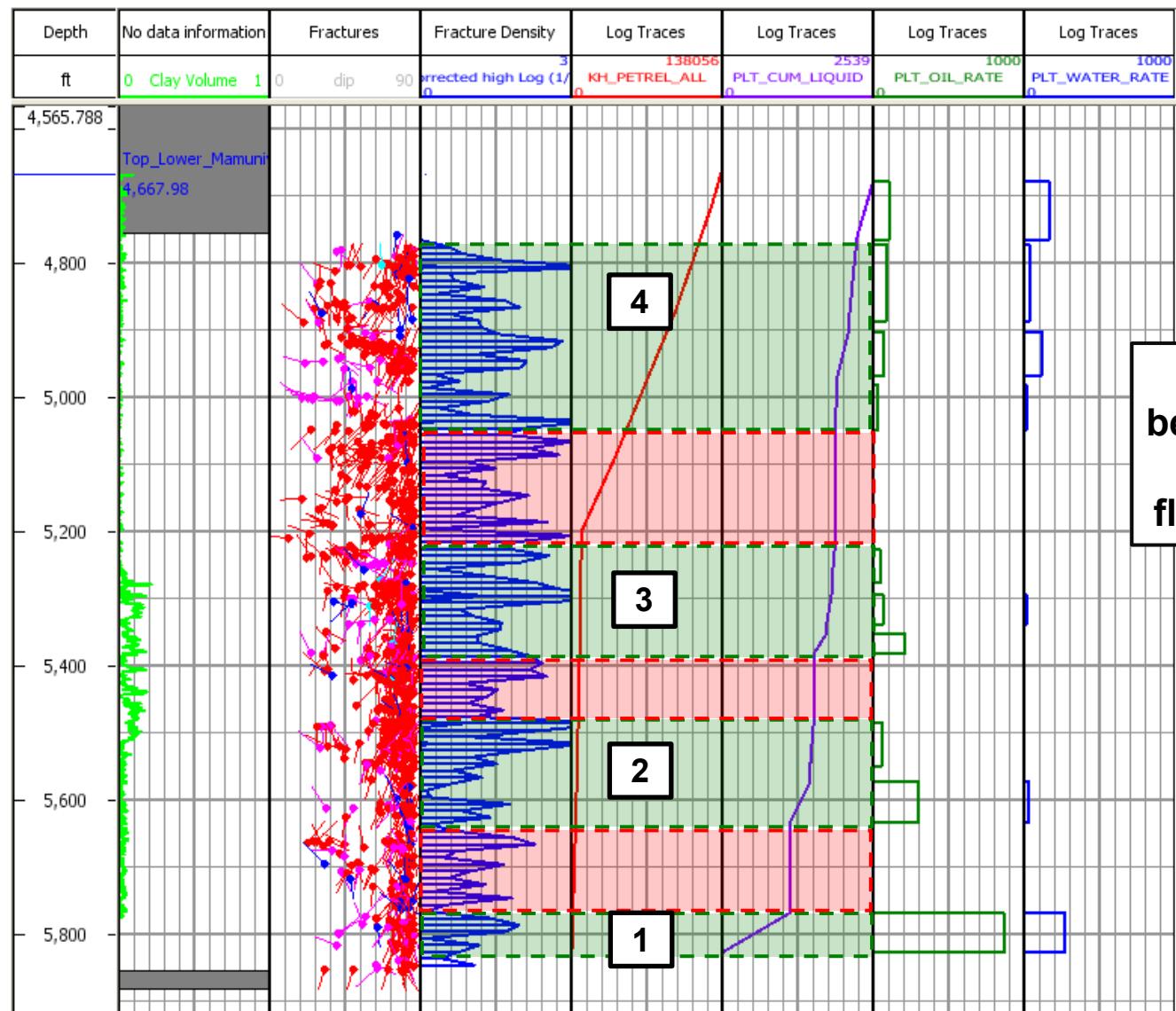
B12H – PLT, all interpreted fractures and cumulative static K.H

**CLUSTER
+
DIFFUSE**



- Major_Conductive_Fracture ■
- Minor_Conductive_Fracture ◆
- Possible_Fault ○
- Possible_Fracture ▲
- Resistive_Fracture ●

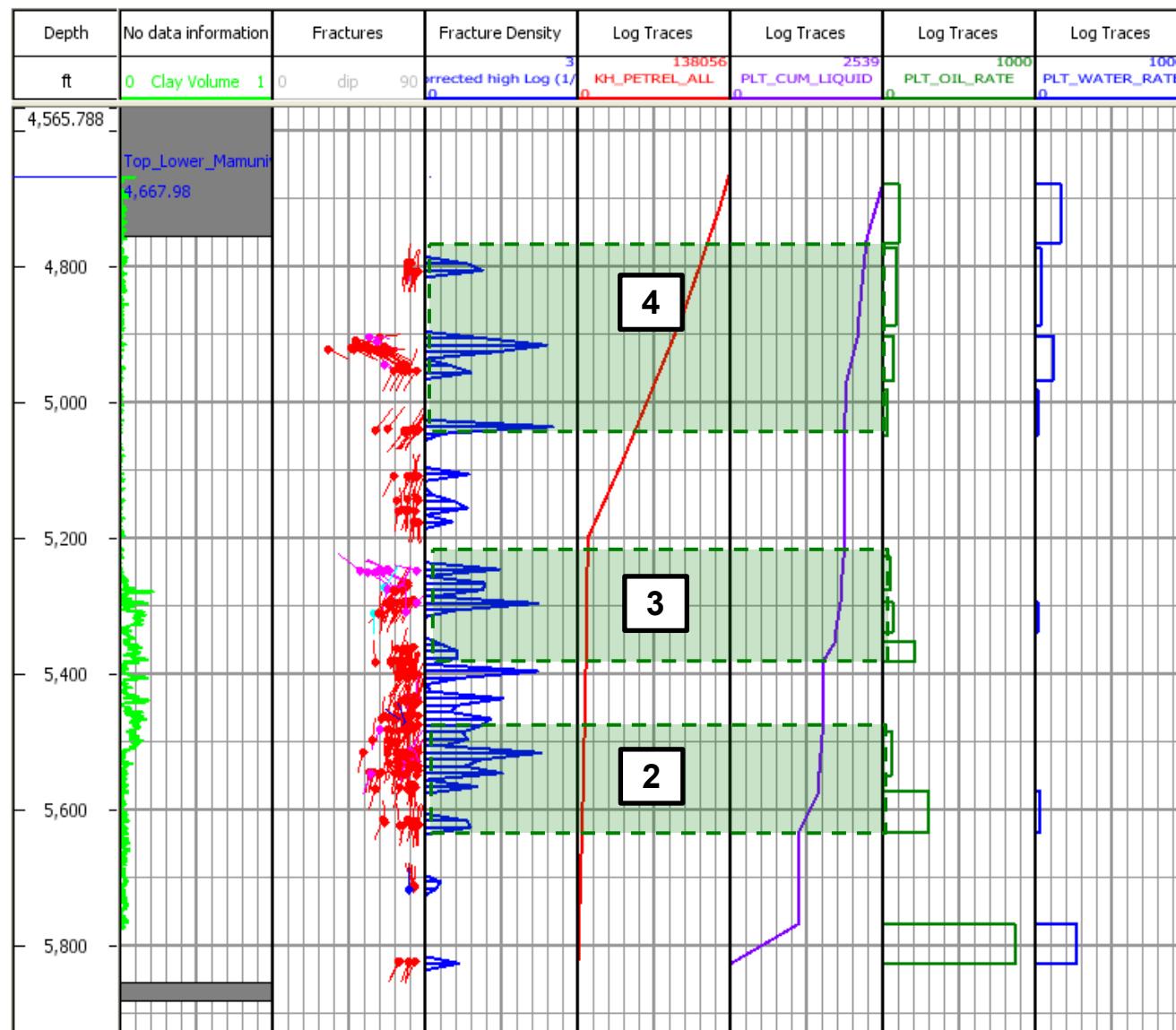
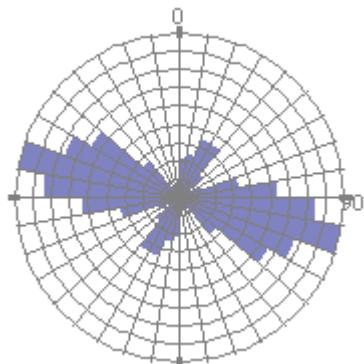
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Sampling = 10 ft



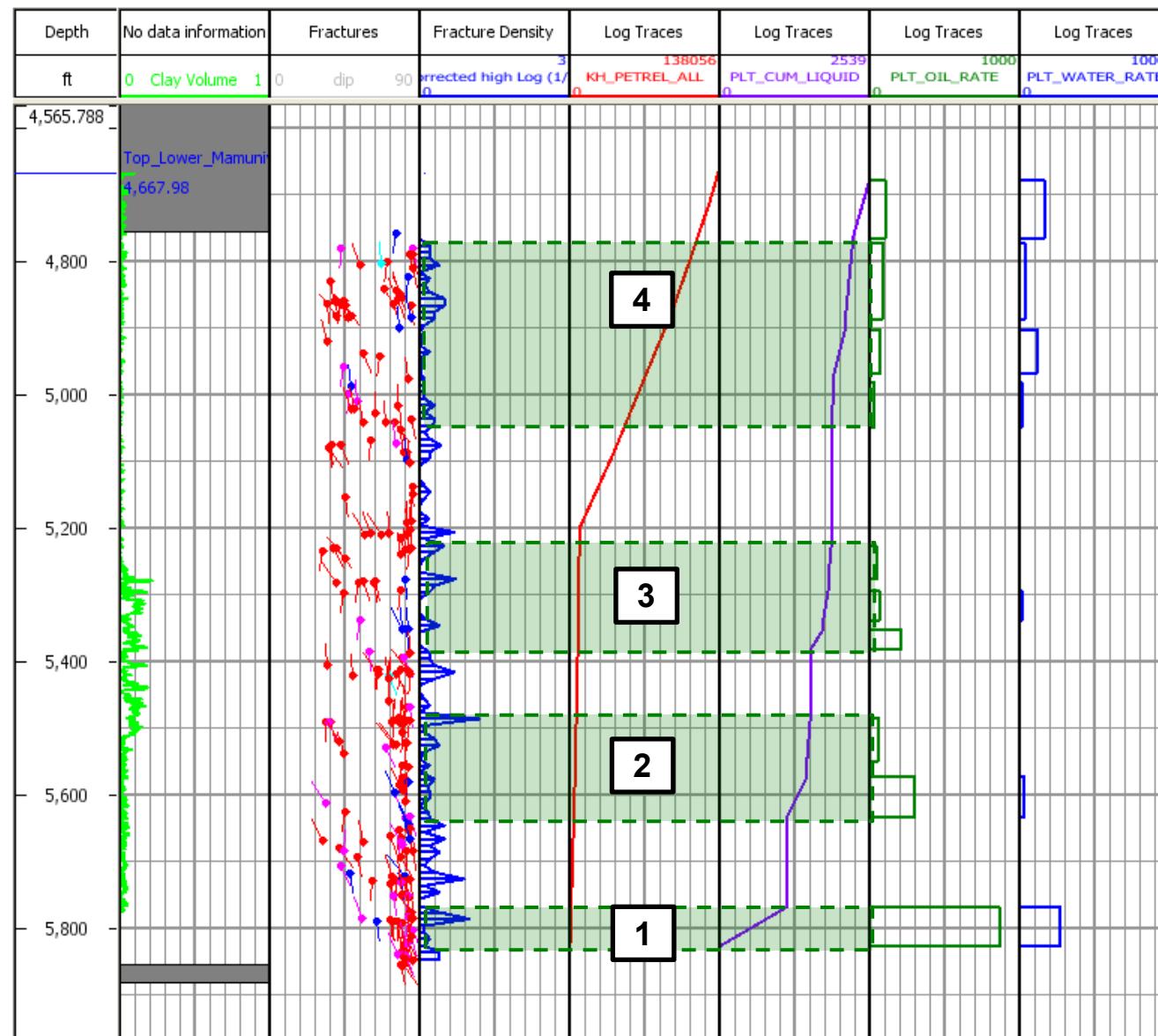
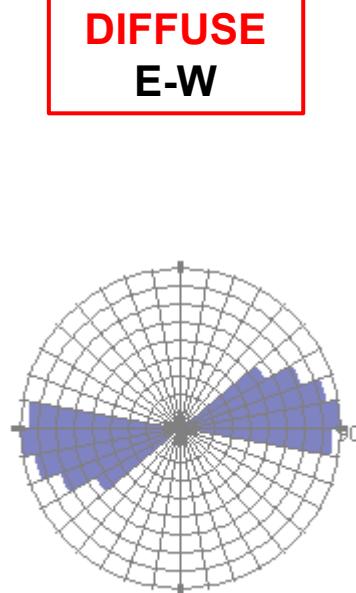
**Relationship
between fracture
presence and
fluid production**

GOOD

LOW

CLUSTER

B12H – Comparison of PLT with fracture clusters only



B12H – Comparison of PLT with E-W diffuse fractures only

**DIFFUSE
NW-SE**

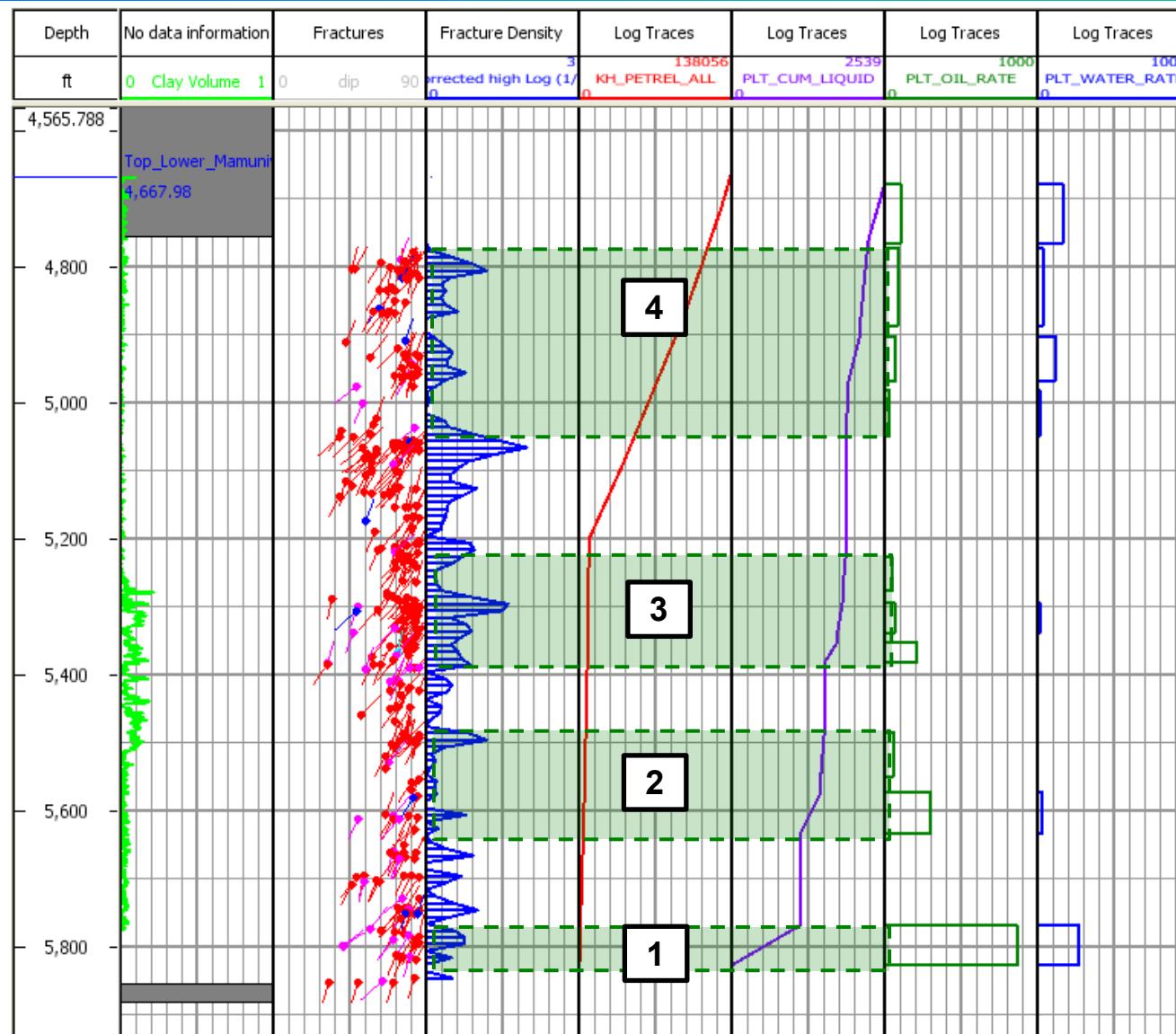
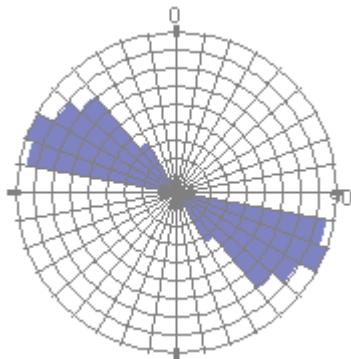


Fig. 5.88

B12H – Comparison of PLT with NE-SW diffuse fractures only

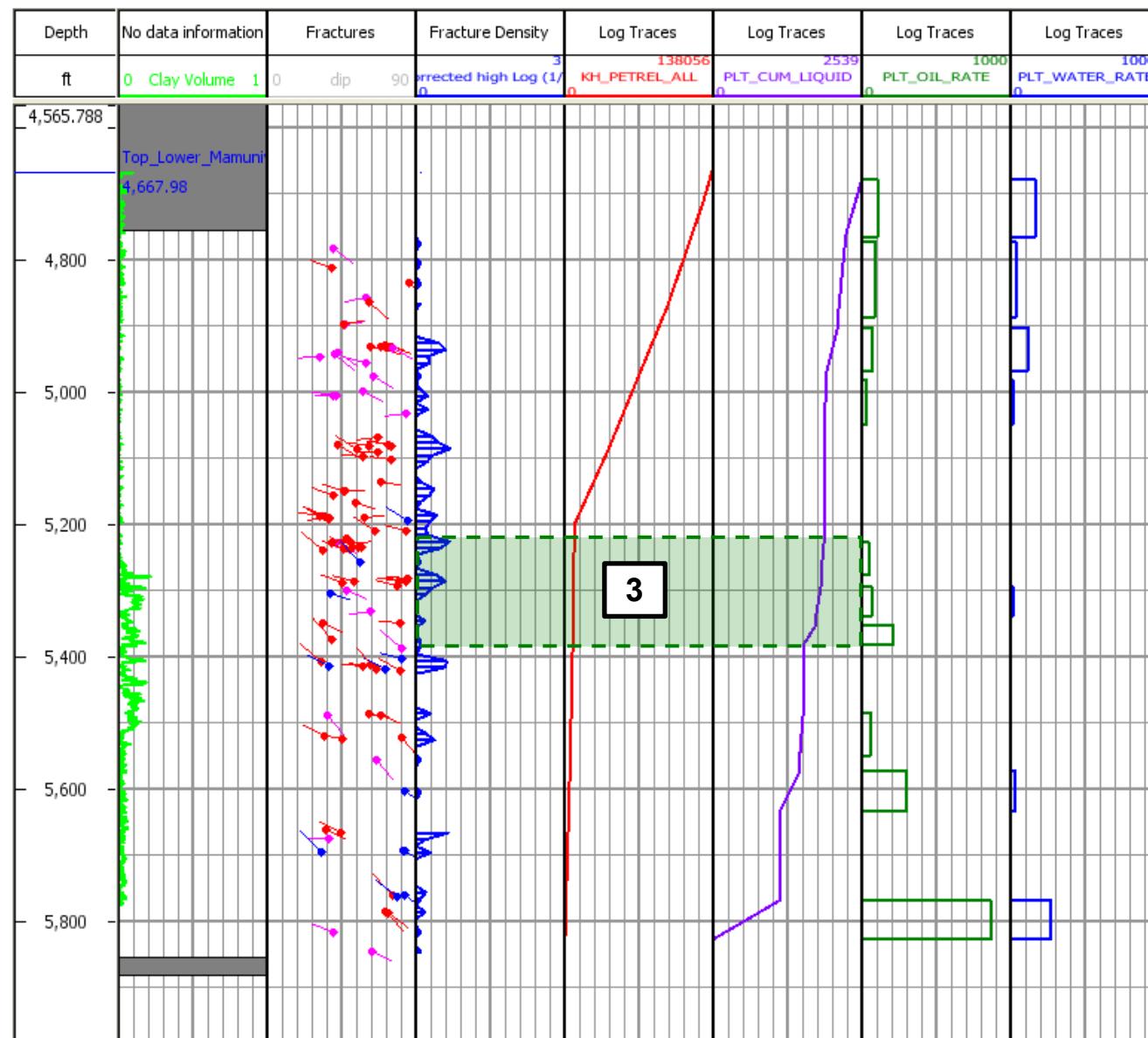
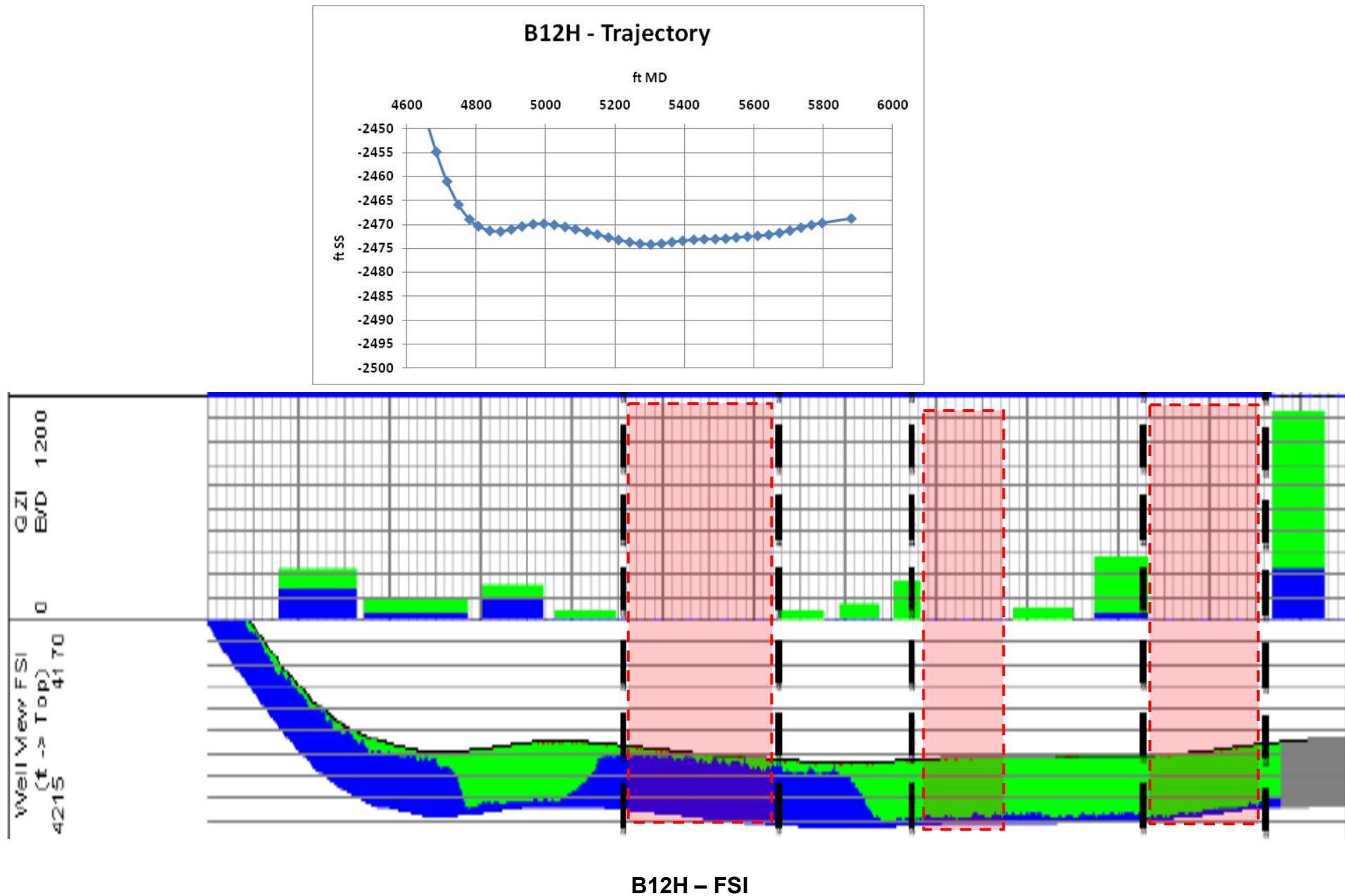
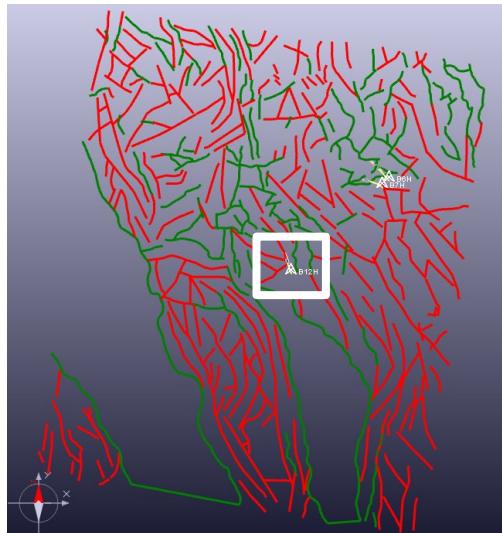


Fig. 5.89

B12H – Comparison of PLT with N-S diffuse fractures only





FAULTS

LINEAMENTS

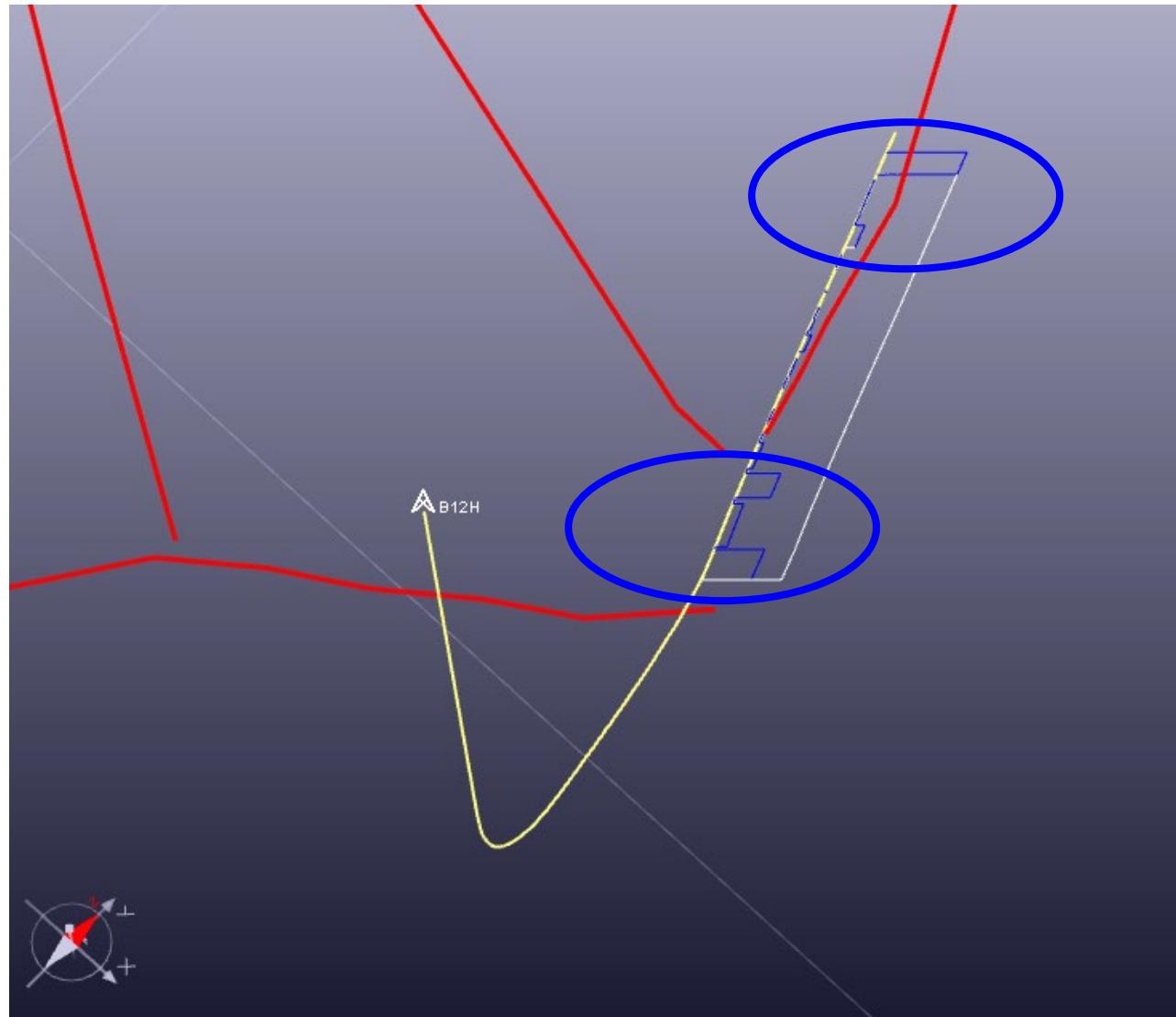
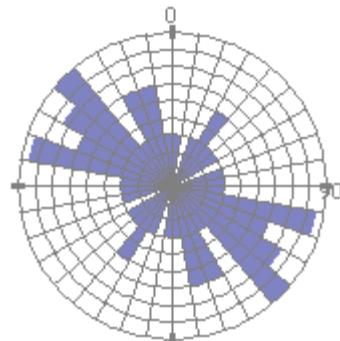


Fig. 5.91

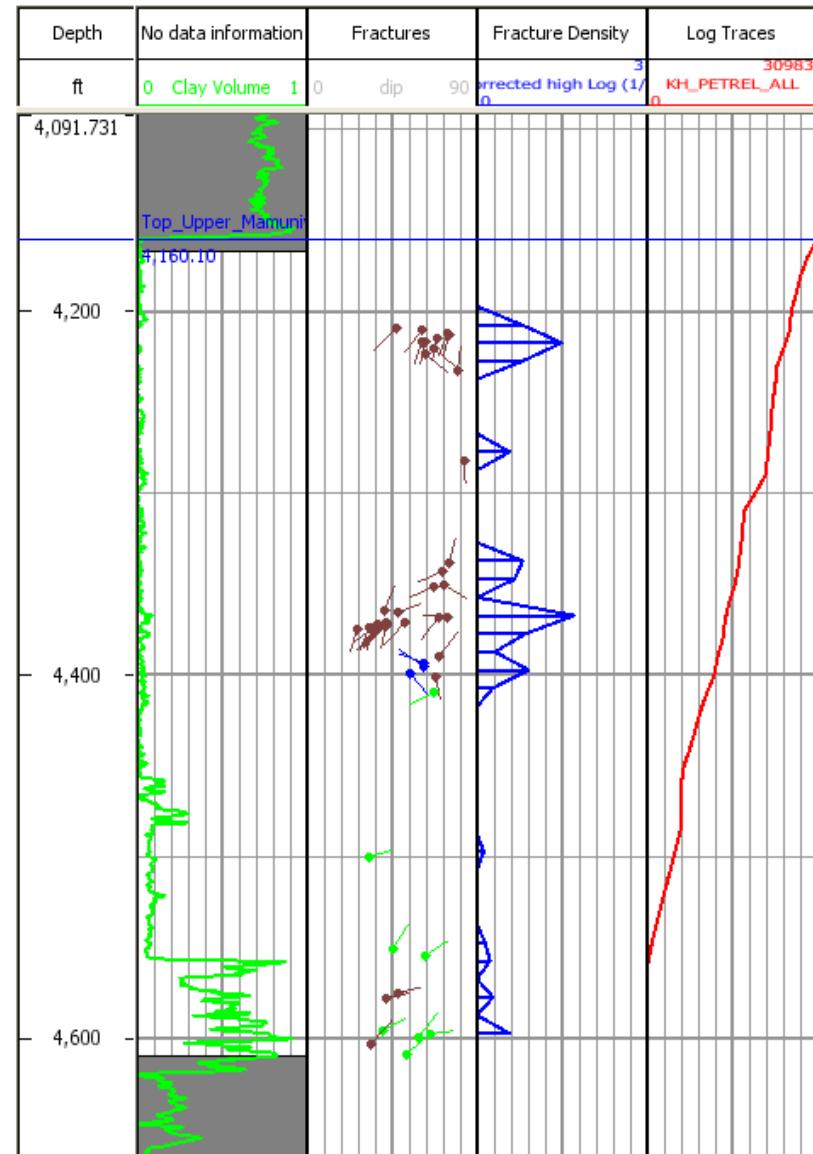
B12H – Water production in PLT and structural objects (3D view)

CLUSTER
+
DIFFUSE



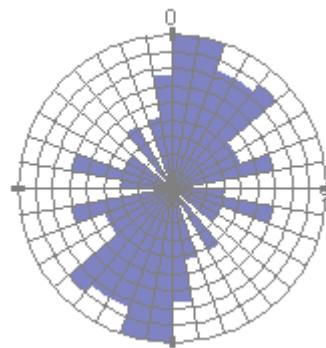
- Cemented_Fracture 
- Fault 
- Micro-Fault 
- Partly_open_Fracture 

*Windows size = 10 ft
Sampling = 10 ft*



B1 – Fracture distribution

CLUSTER
+
DIFFUSE



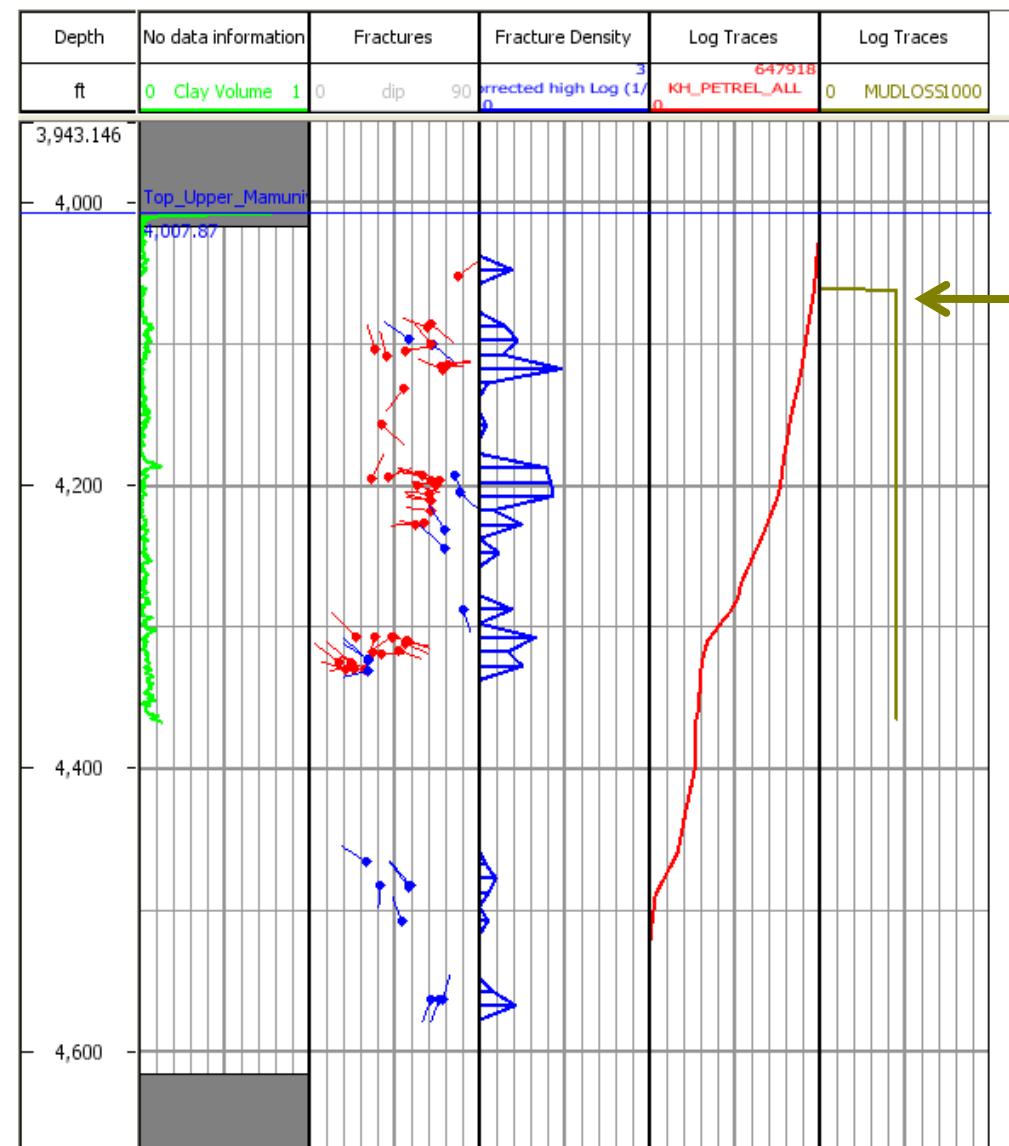
Conductive_Fracture



Resistive_Fracture

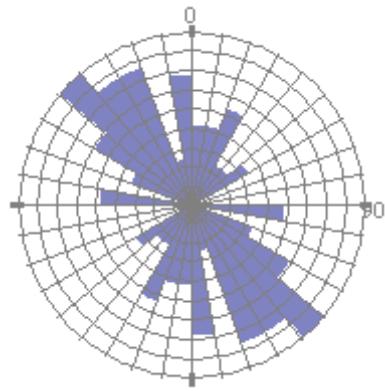


Windows size = 10 ft
Sampling = 10 ft



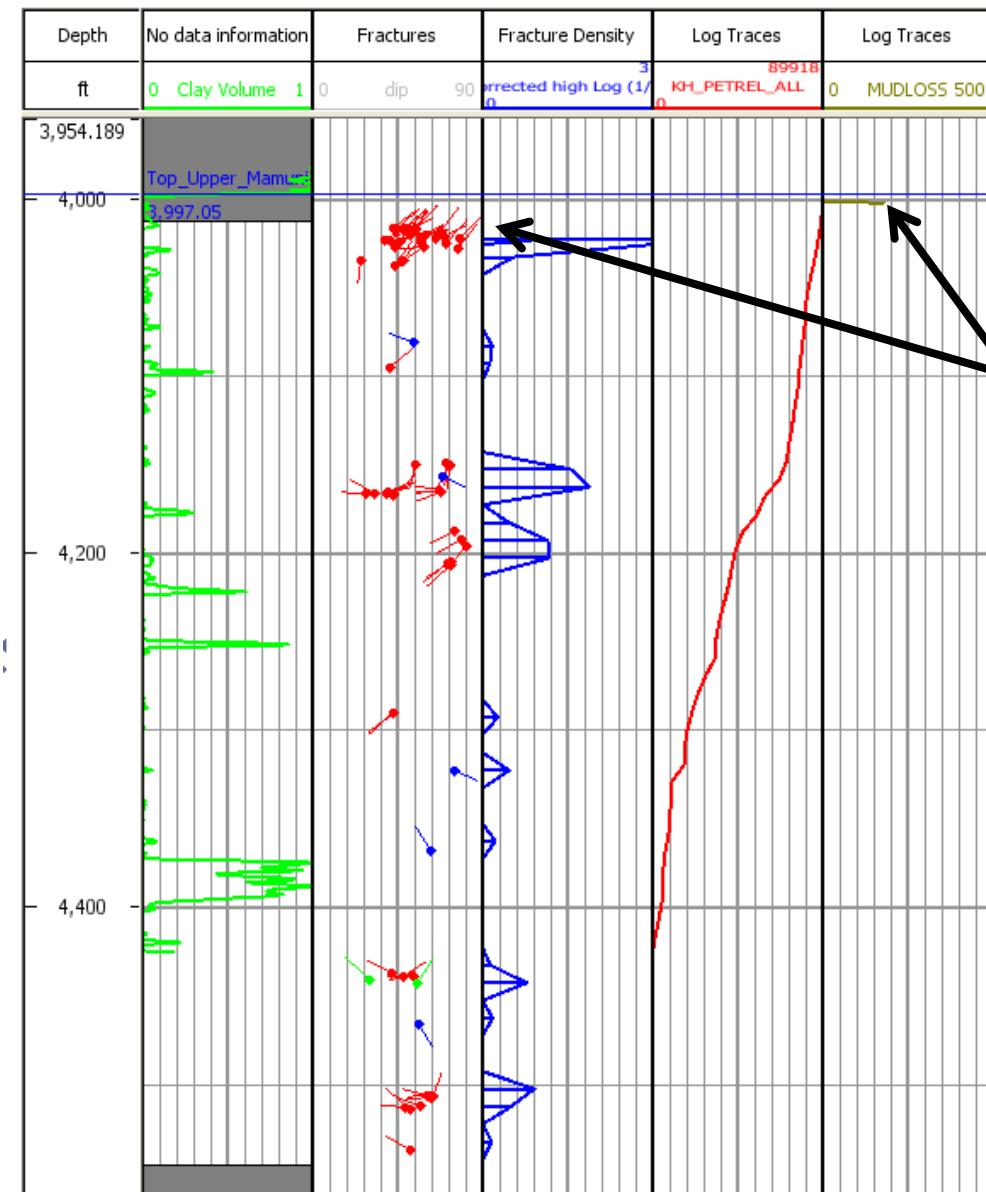
B2 – Fracture distribution and mud losses

CLUSTER
+
DIFFUSE



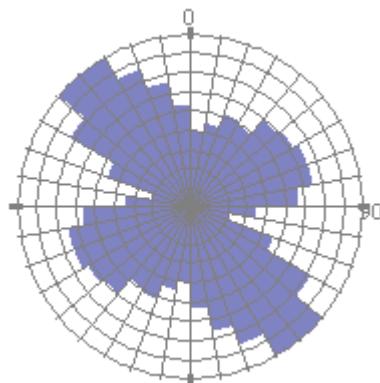
Conductive_Fracture ◆
Fault ▲
Induced_Fracture ■
Resistive_Fracture ●

Windows size = 10 ft
Sampling = 10 ft



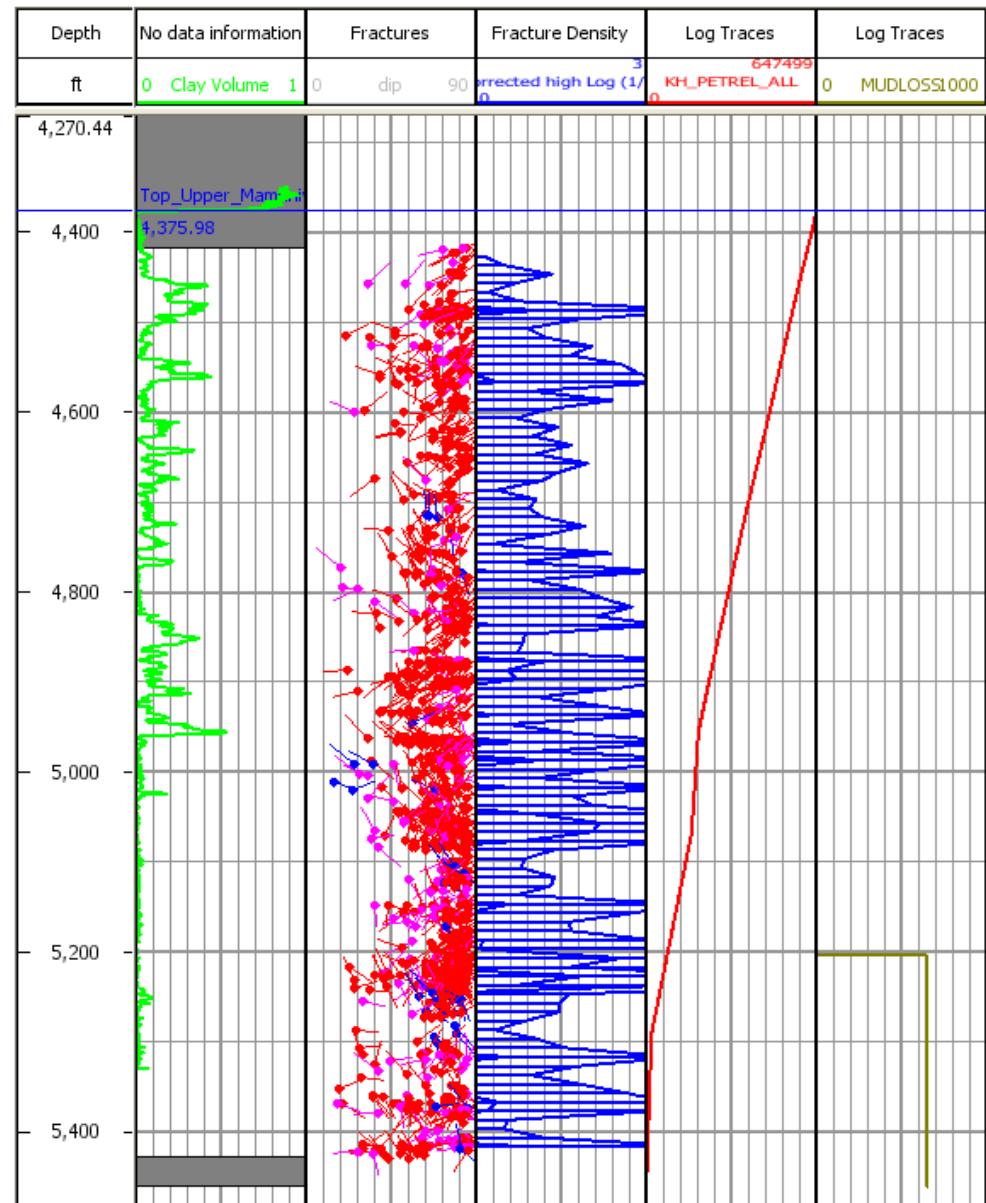
B3 – Fracture distribution and mud losses

CLUSTER
+
DIFFUSE



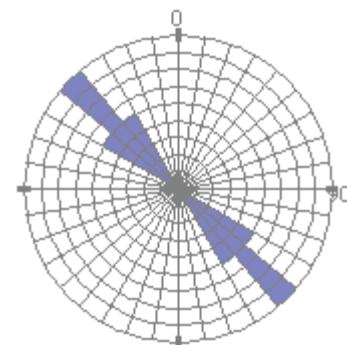
- Major_Conductive_Fracture ■
- Minor_Conductive_Fracture ◆
- Possible_Fracture ▲
- Resistive_Fracture ●

Windows size = 10 ft
Sampling = 10 ft

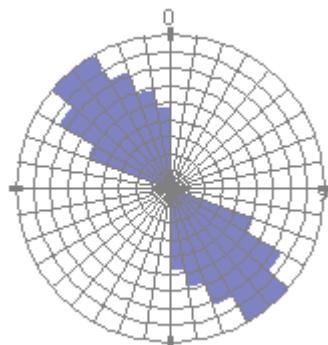


B10H – Fracture distribution and mud losses

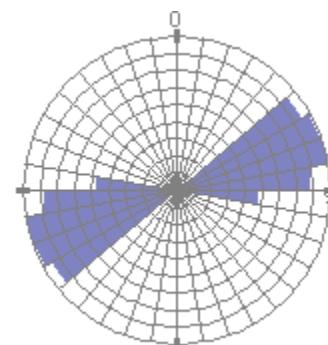
Cluster #15



**Diffuse
NW-SE**



**Diffuse
E-W**



**Diffuse
NE-SW**

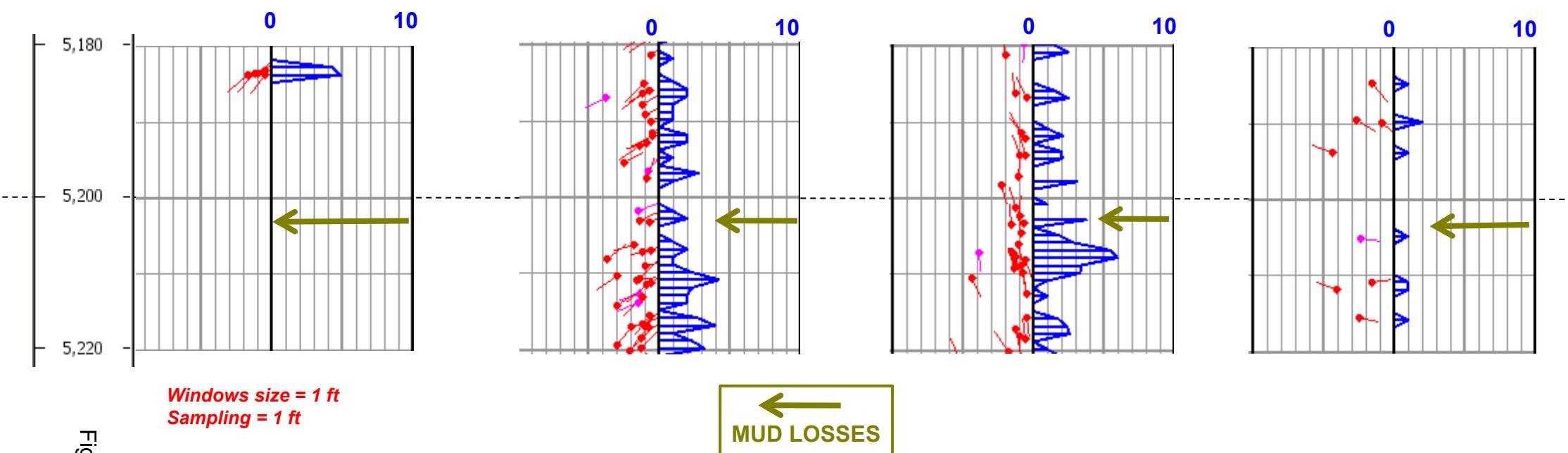
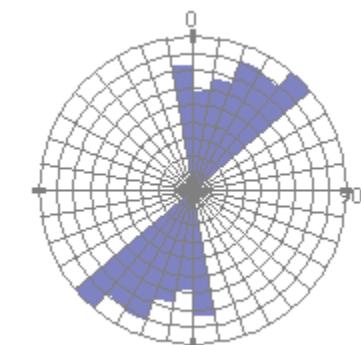


Fig. 5.96

B10H – Zoom on mud losses

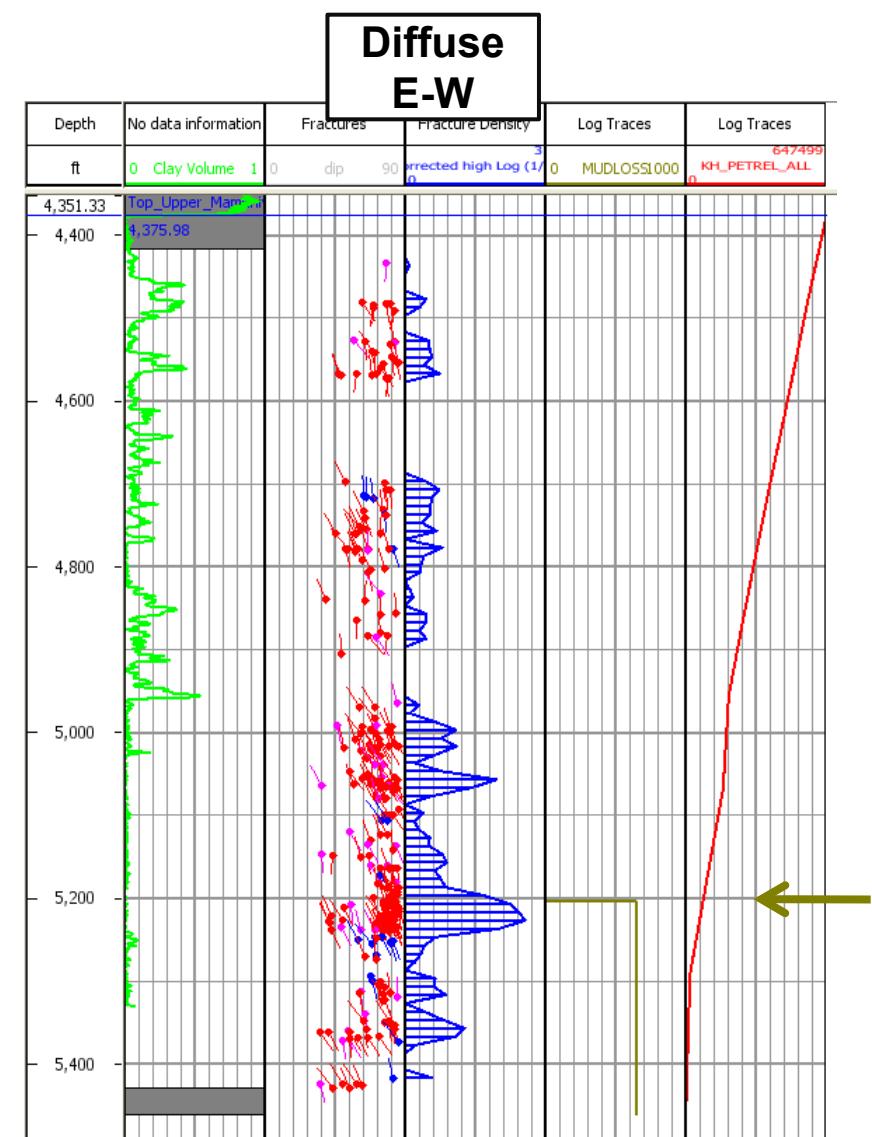
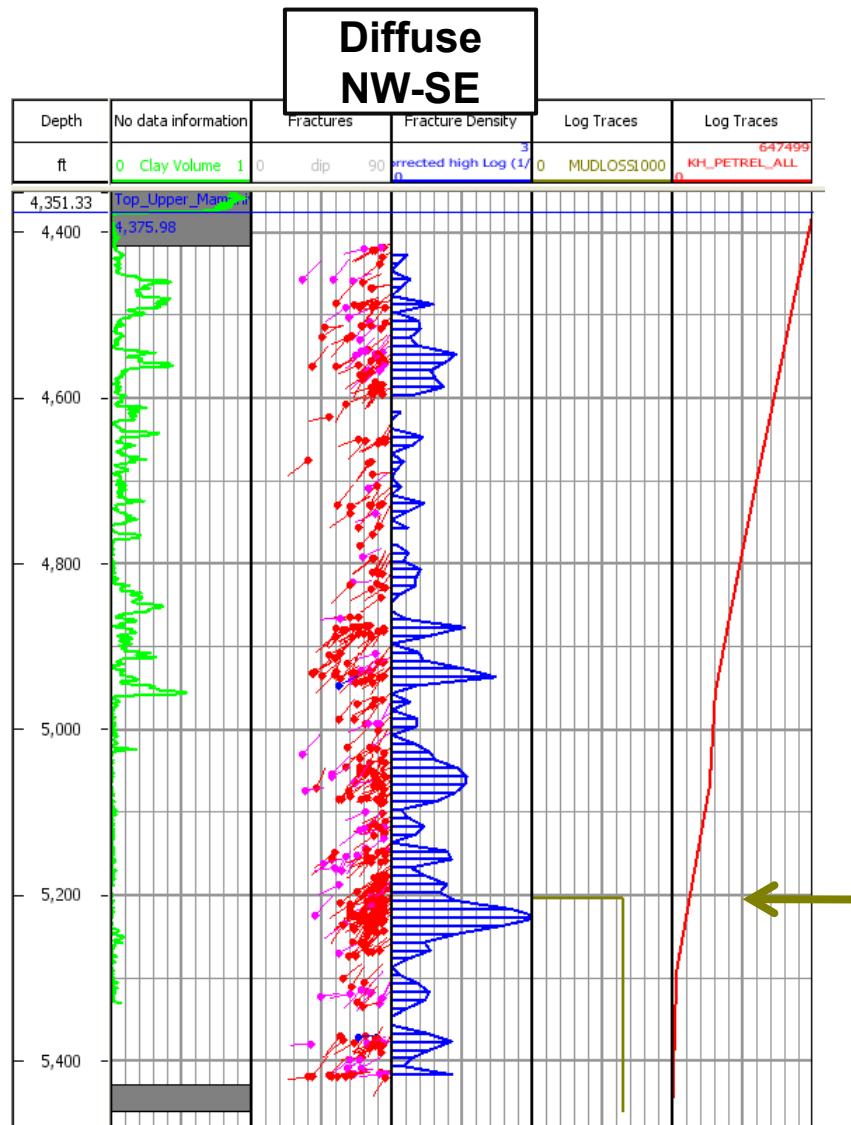
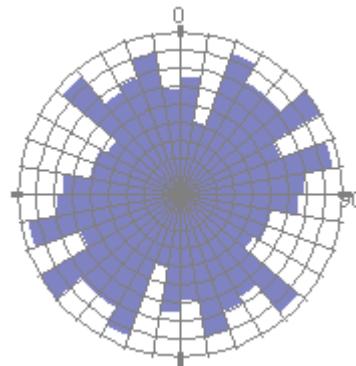


Fig. 5.97

Windows size = 10 ft
Sampling = 10 ft

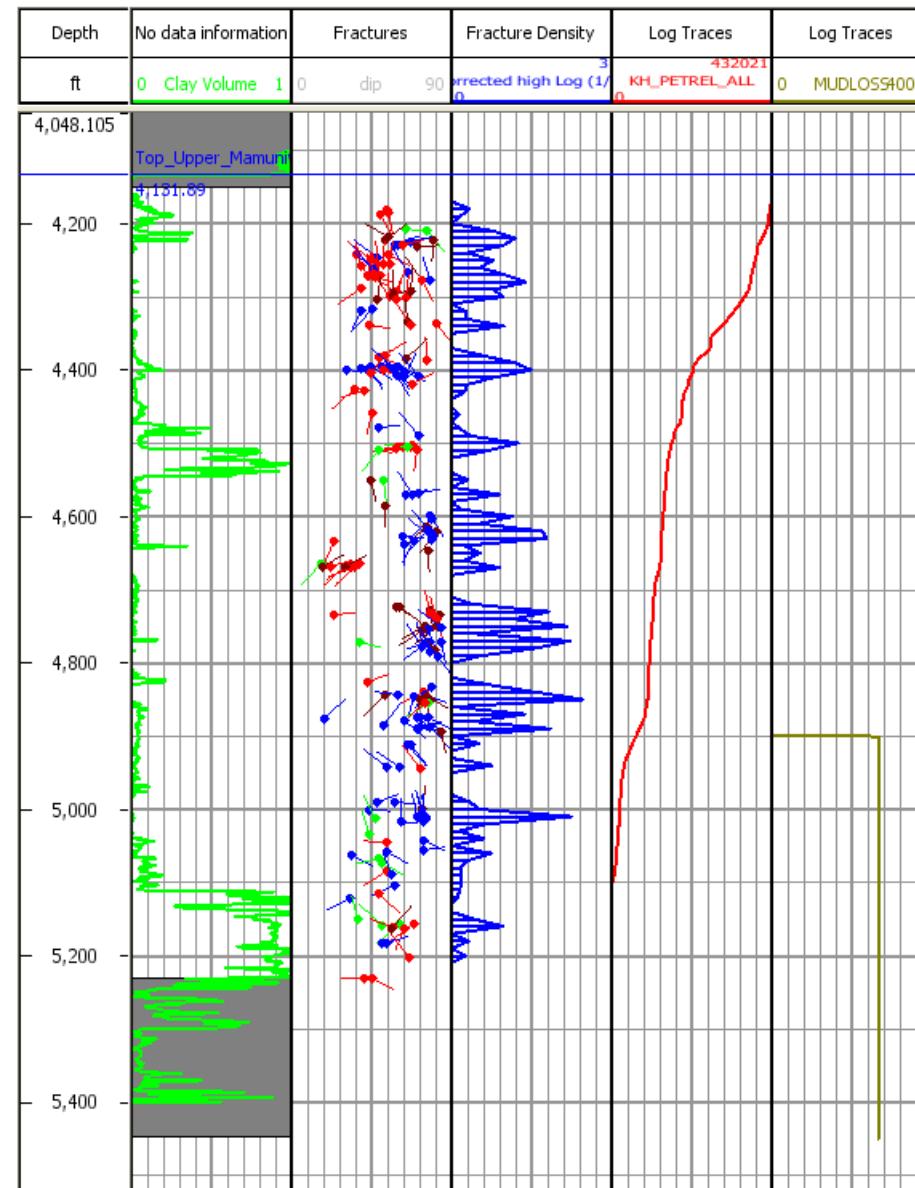
B10H – NW-SE and E-W diffuse fractures and mud losses

CLUSTER
+
DIFFUSE



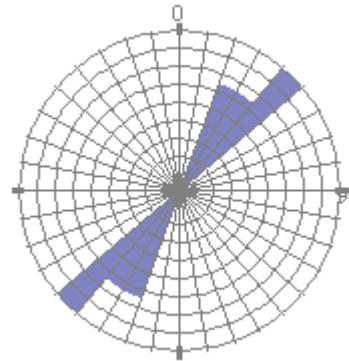
- Conductive_Fract_Discont
- Conductive_Fracture
- Discont_Fracture
- Fault
- Resistive_Fracture
- Resistive_Fracture_Discont

Windows size = 10 ft
Sampling = 10 ft

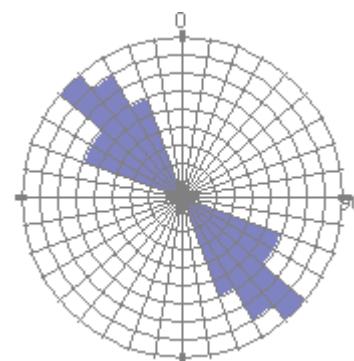


B14P – Fracture distribution and mud losses

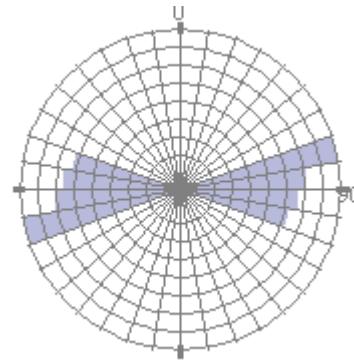
Cluster #6



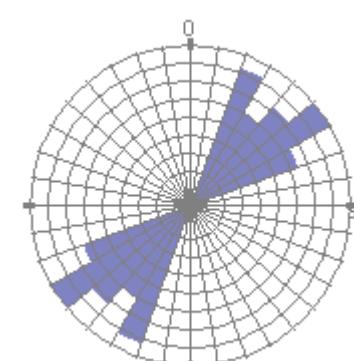
**Diffuse
NW-SE**



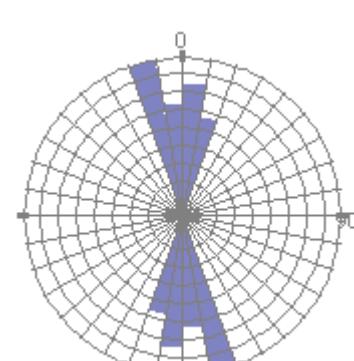
**Diffuse
E-W**



**Diffuse
NE-SW**



**Diffuse
N-S**



0 5

0 5

0 5

0 5

0 5

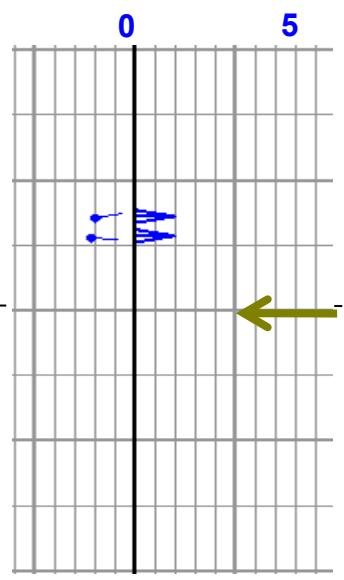
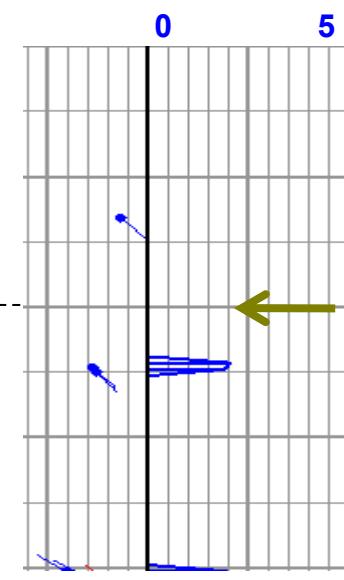
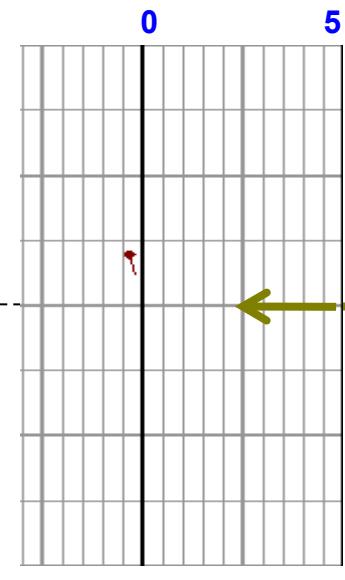
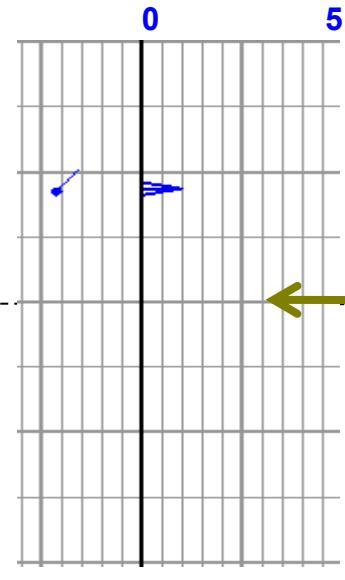
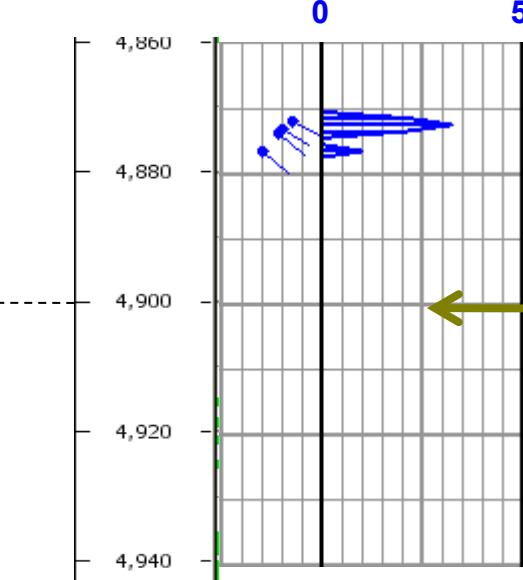


Fig. 5.99

**Windows size = 1 ft
Sampling = 1 ft**

B14P – Zoom on mud losses

MUD LOSSES