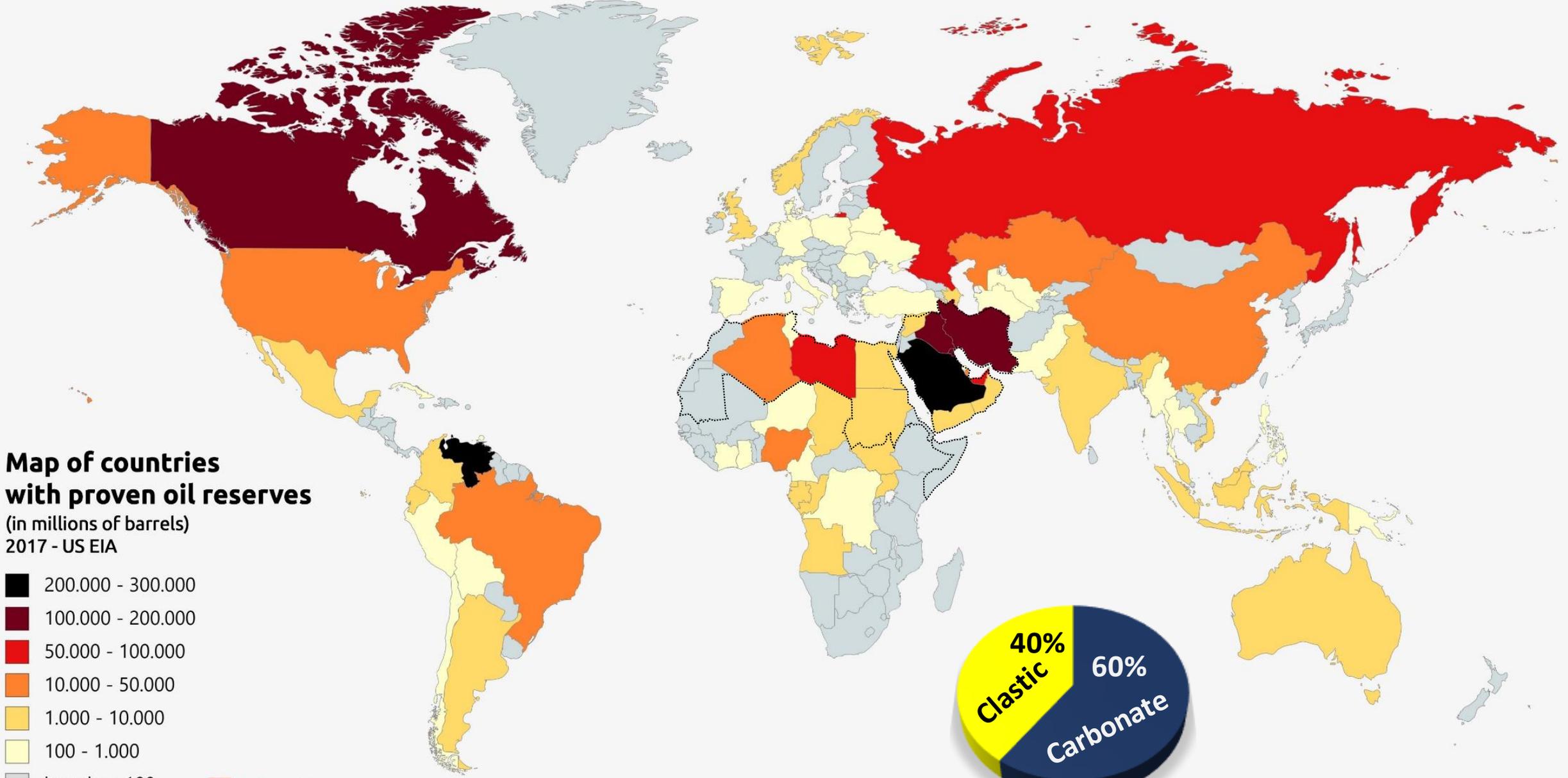


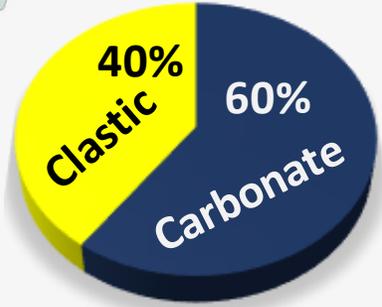
Abu Roash F Potentiality Challenges, Abu Sennan Field Western Desert

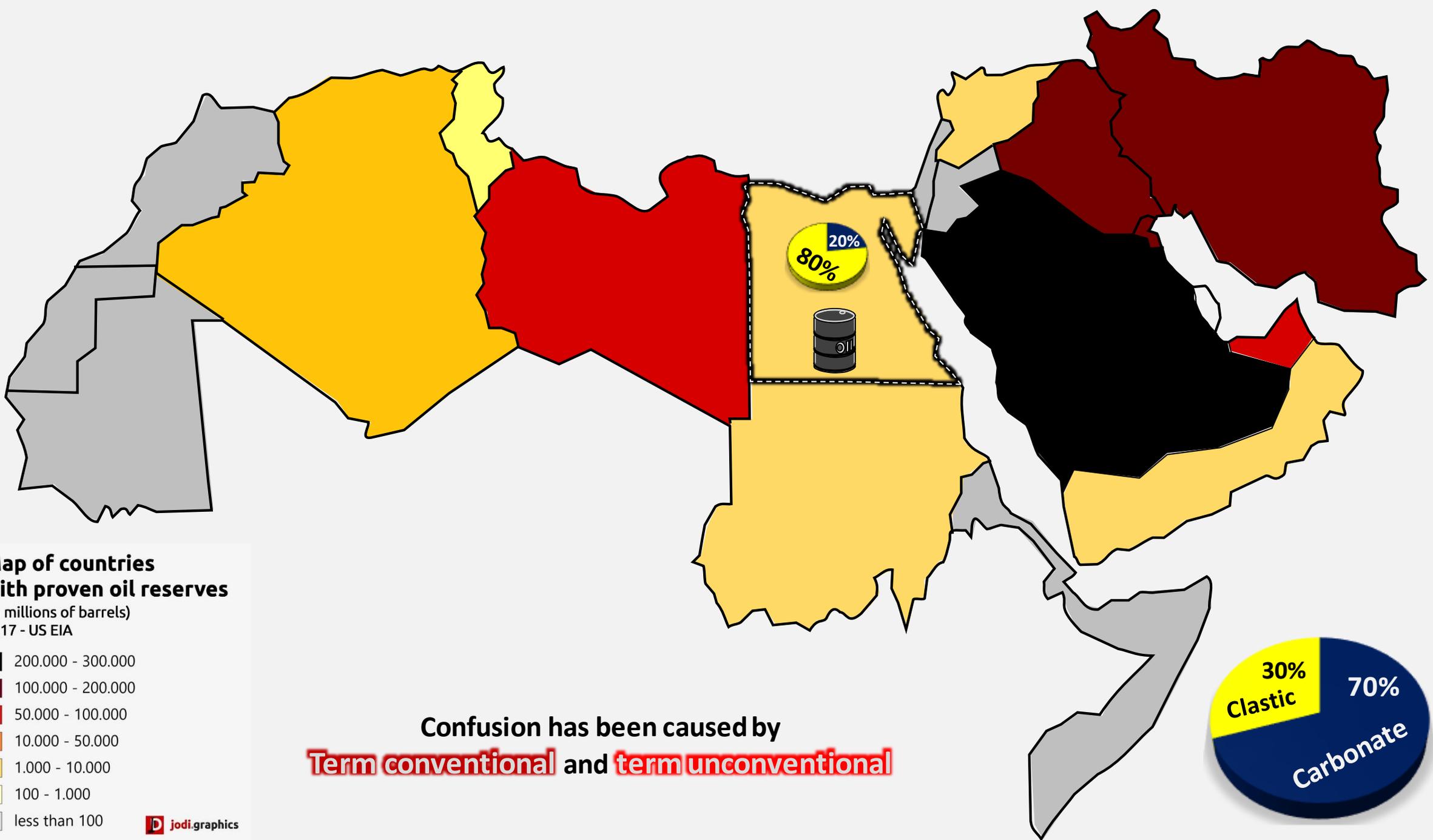


Map of countries with proven oil reserves

(in millions of barrels)
2017 - US EIA

- 200.000 - 300.000
- 100.000 - 200.000
- 50.000 - 100.000
- 10.000 - 50.000
- 1.000 - 10.000
- 100 - 1.000
- less than 100





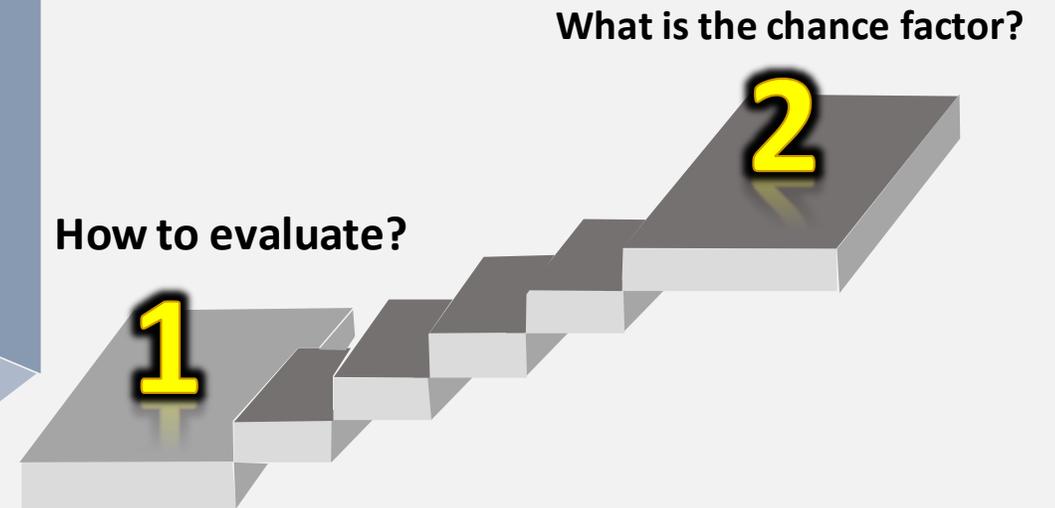
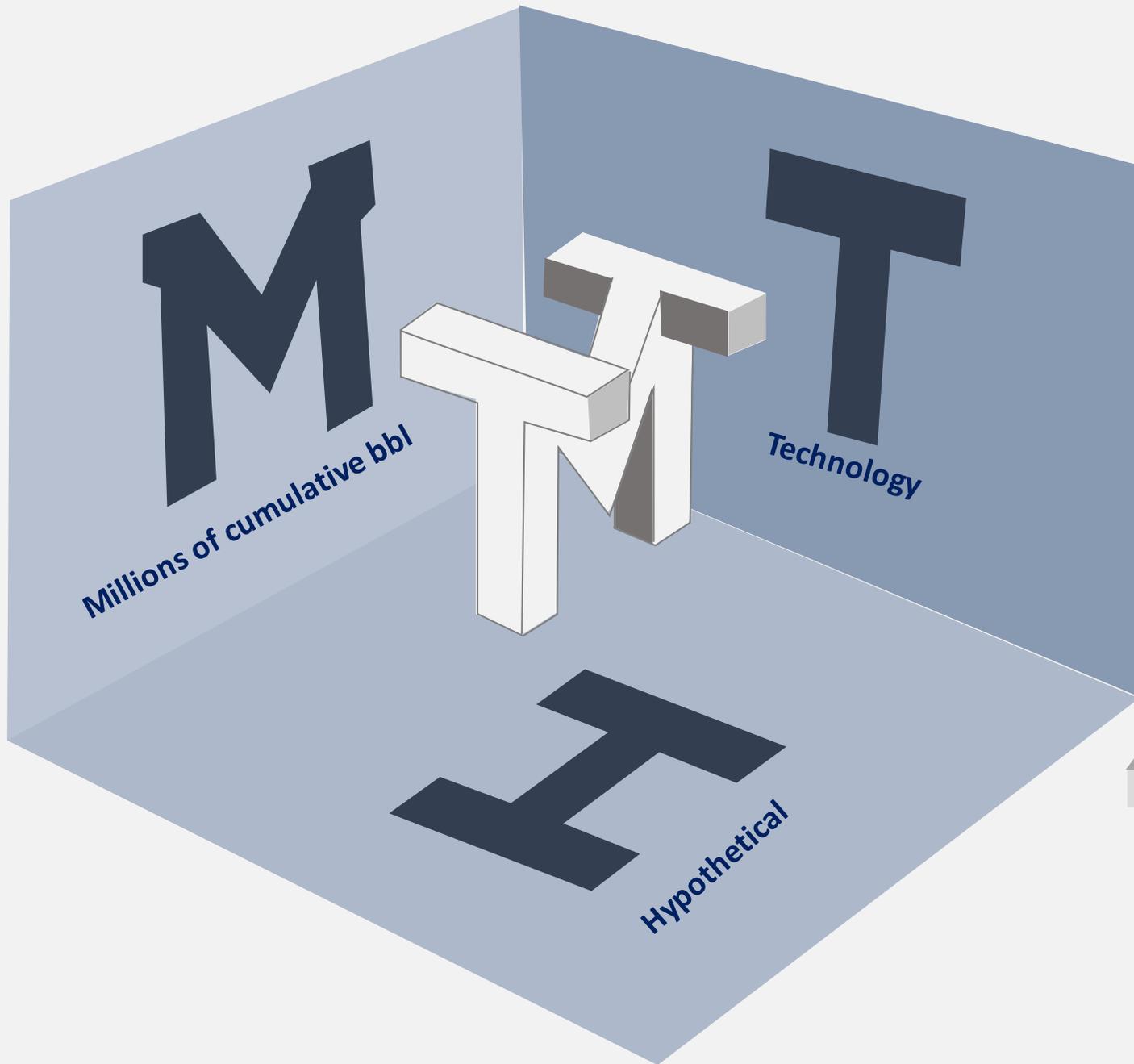
Map of countries with proven oil reserves

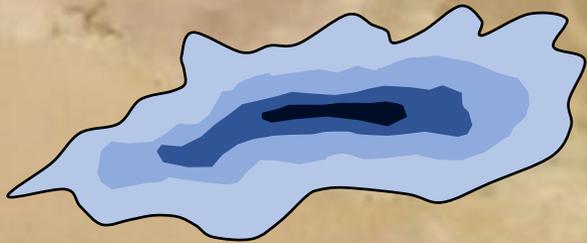
(in millions of barrels)
2017 - US EIA

- 200.000 - 300.000
- 100.000 - 200.000
- 50.000 - 100.000
- 10.000 - 50.000
- 1.000 - 10.000
- 100 - 1.000
- less than 100

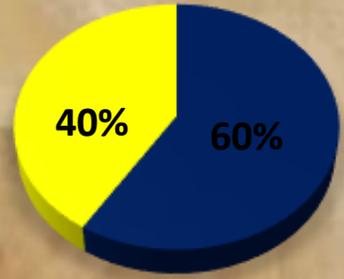
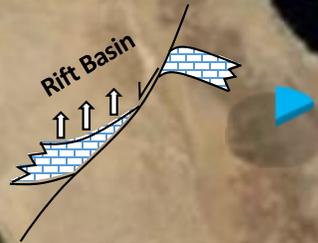
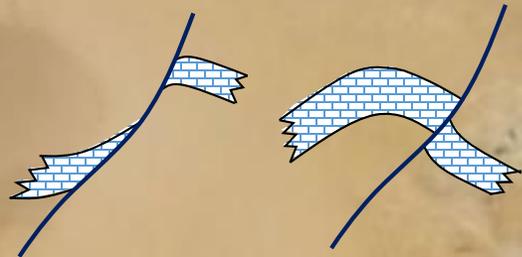
Confusion has been caused by
Term conventional and **term unconventional**

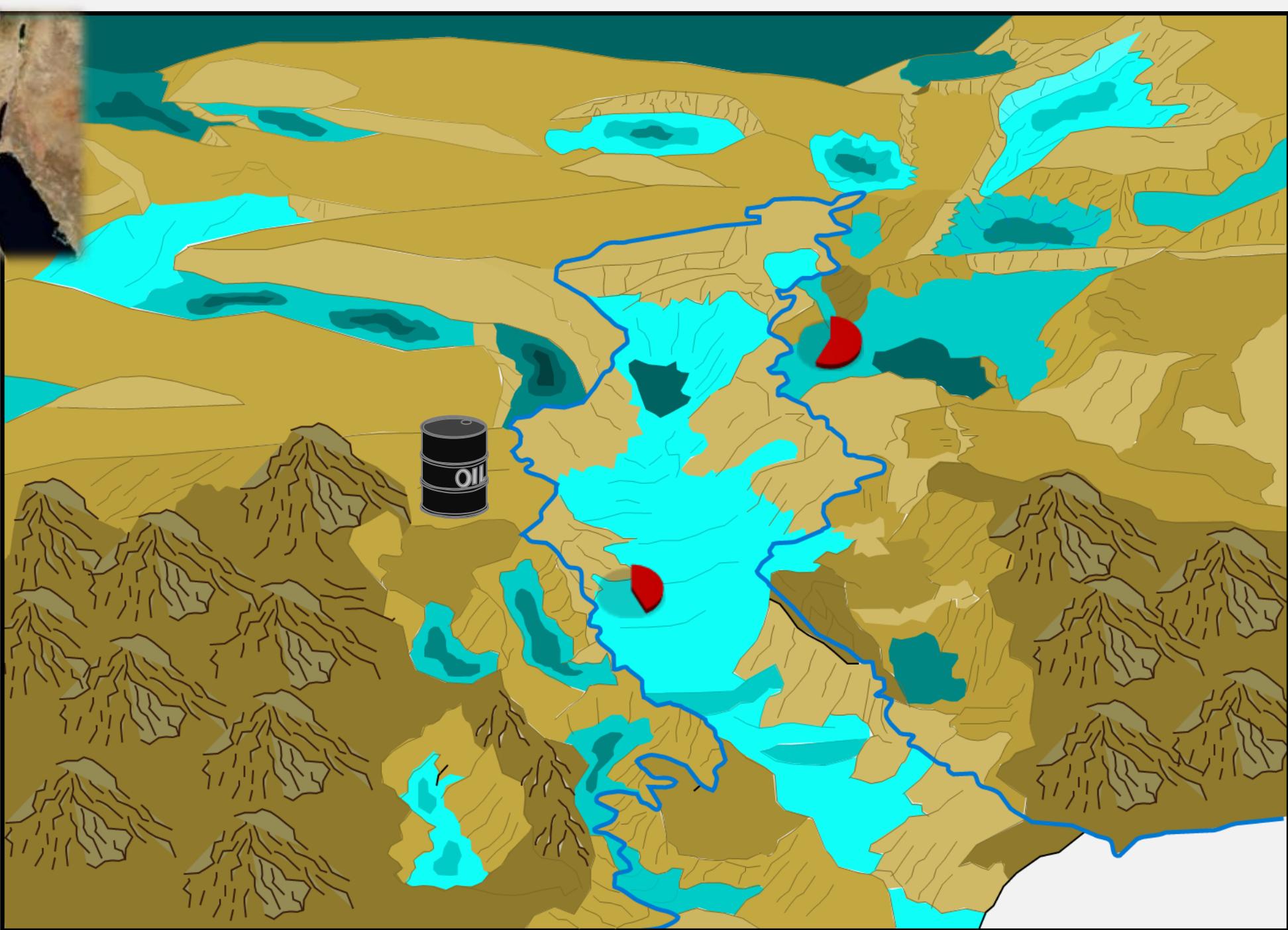






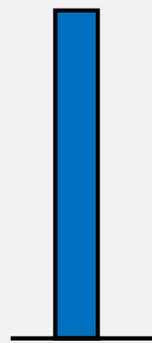
Heavy oil
Tar Sand

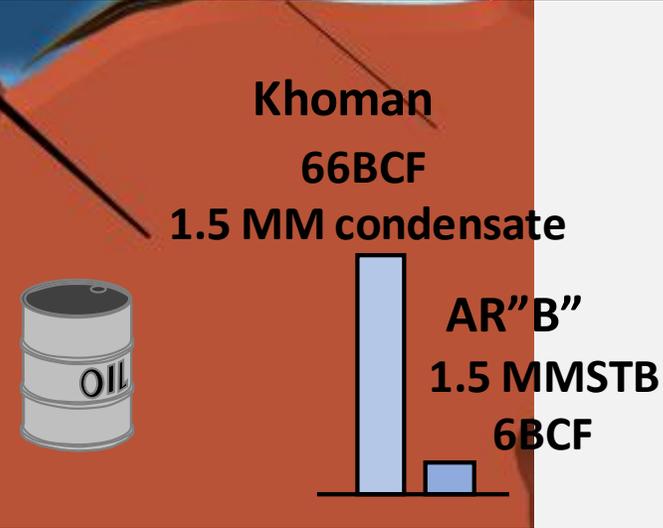
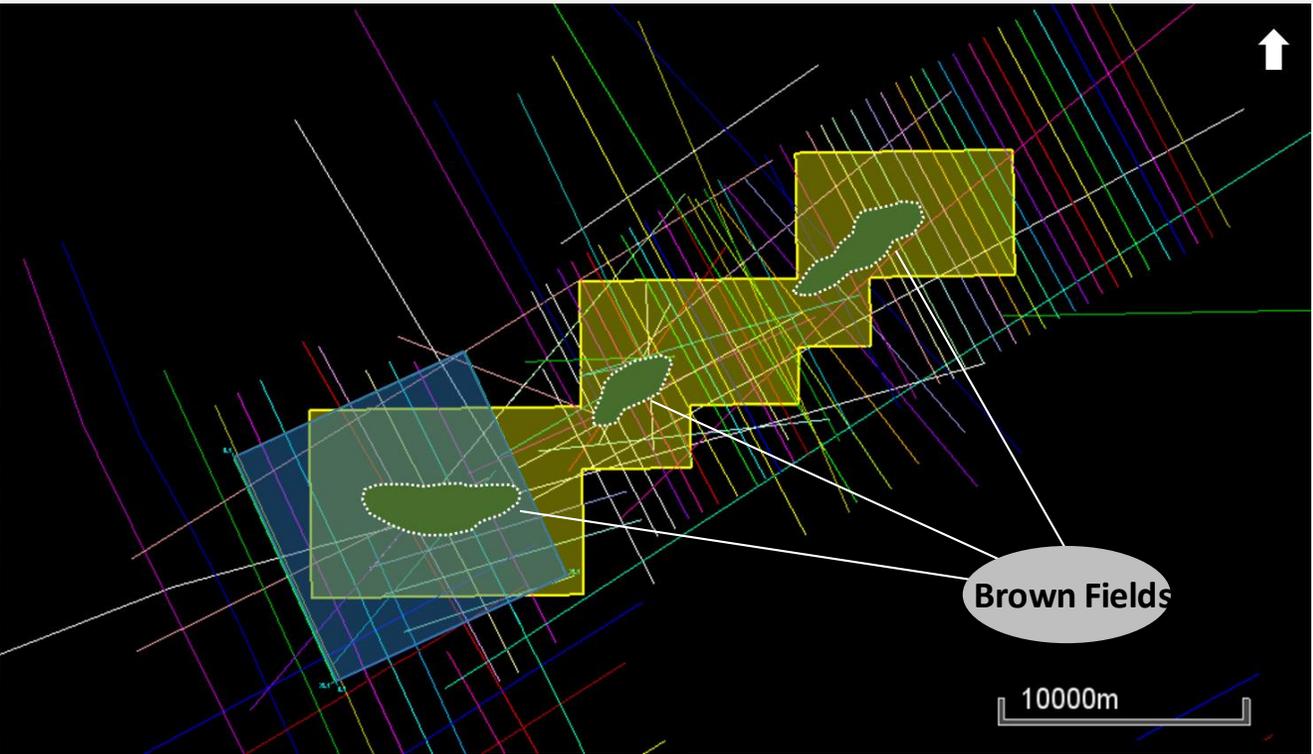
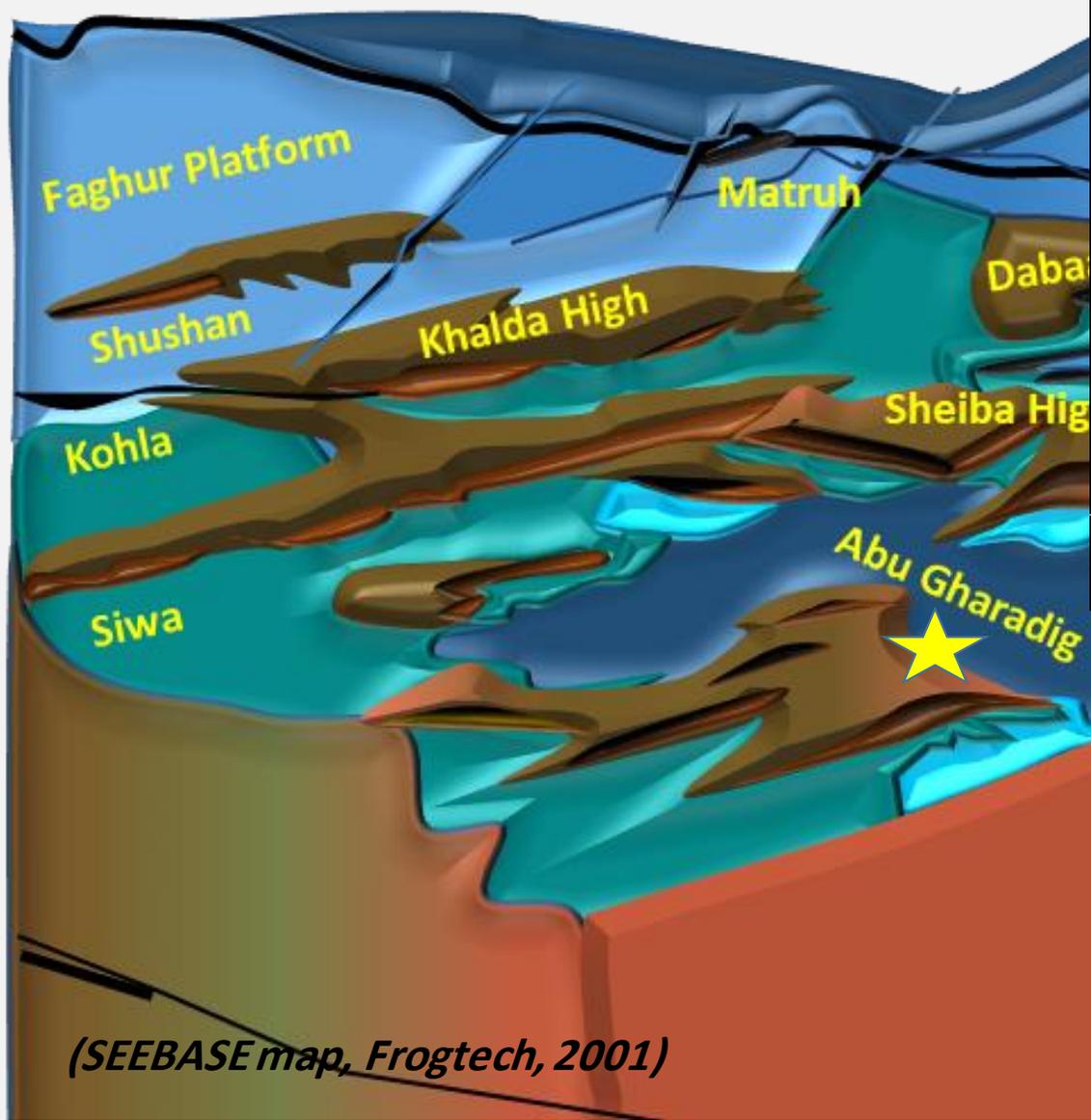




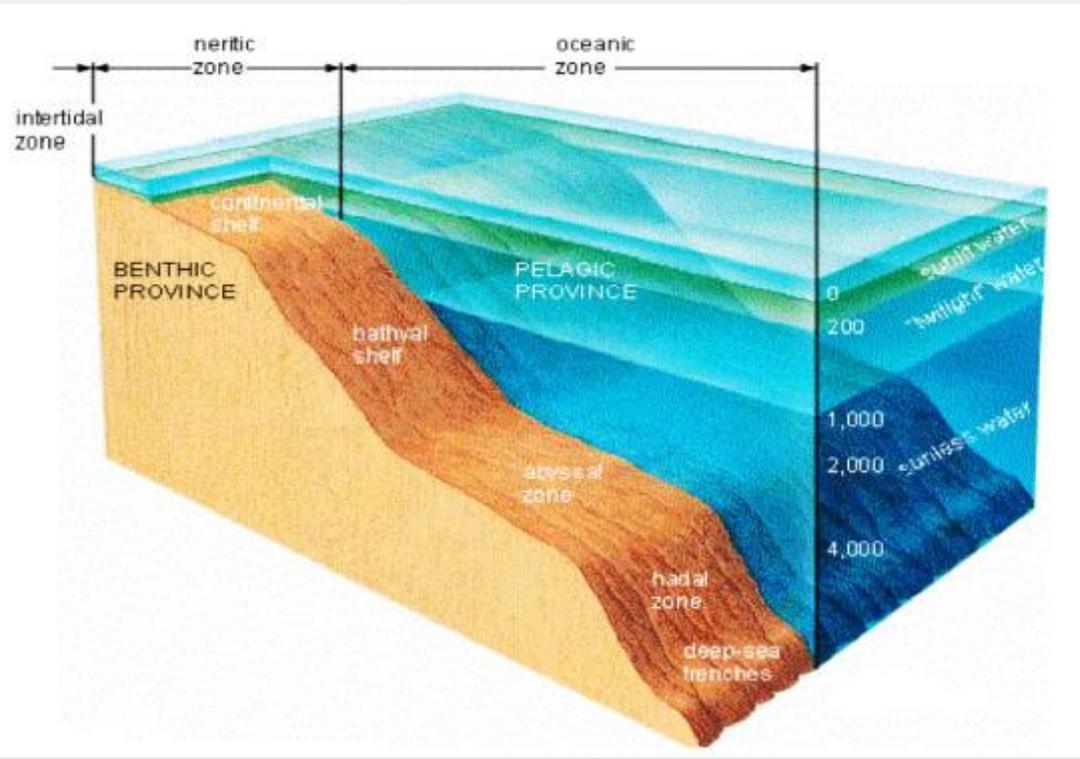
Eocene cum. production

176 MMSTB

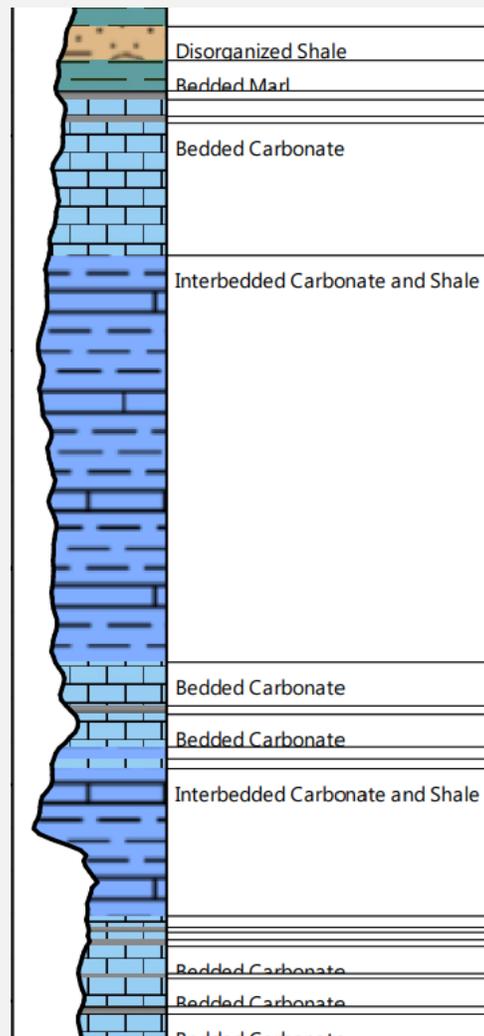




Depositional environments



Outer-neritic Carbonate deposits



ERA	System	Series	Stage	Time MA	Western Desert		
Cenozoic	Tertiary	Neogene	Pleistocene		1.8		
			Pliocene	Messinian	5.3		
				Tortonian	7.1		
				Serravalian	10.2		
				Langhian	15.2	Maramarica Ls.	
		Paleogene	Miocene	Burdigalian	16.2	Mogra	Mamura
				Aquitanian	20.5		
			Oligocene		23.8	Dabaa	
			Eocene		33.7	Apollonia	
			Paleocene		54.8		
Mesozoic	Cretaceous	Upper	Maastrichtian	65			
			Campanian	71.3	Khoman		
			Cenomanian	93.5	Abu Roash		
			Albian	99	Bahariya		
			Aptian	112	Alamein		
		Lower	Neocomian	121	AEB		
				144	Masajid		
				159	Khatatba		
				180	Yakout shale		
				180	Wadi Natrun		
Paleozoic	Tr.	Permian		206	Bahrein		
				248			
				290			
				354			
				417			
		Carb.		443			
				490			
				543			

(Dolson et al., 2014)

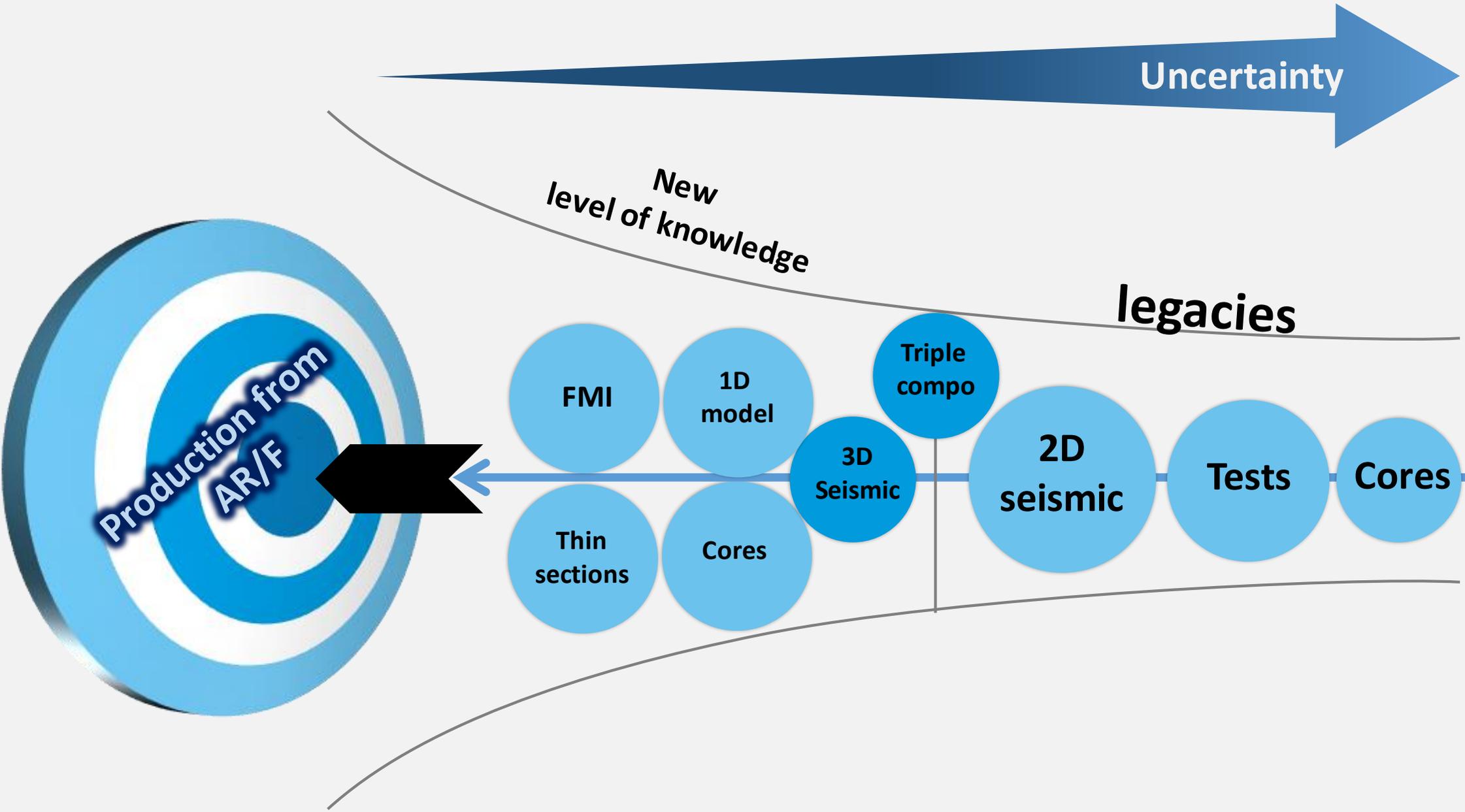
Uncertainty

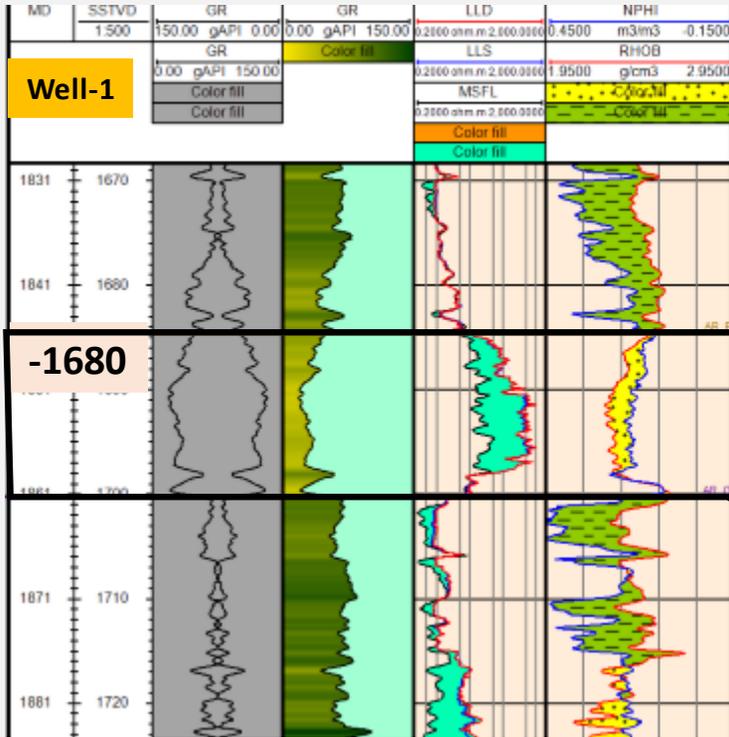
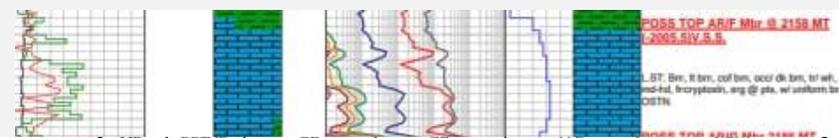
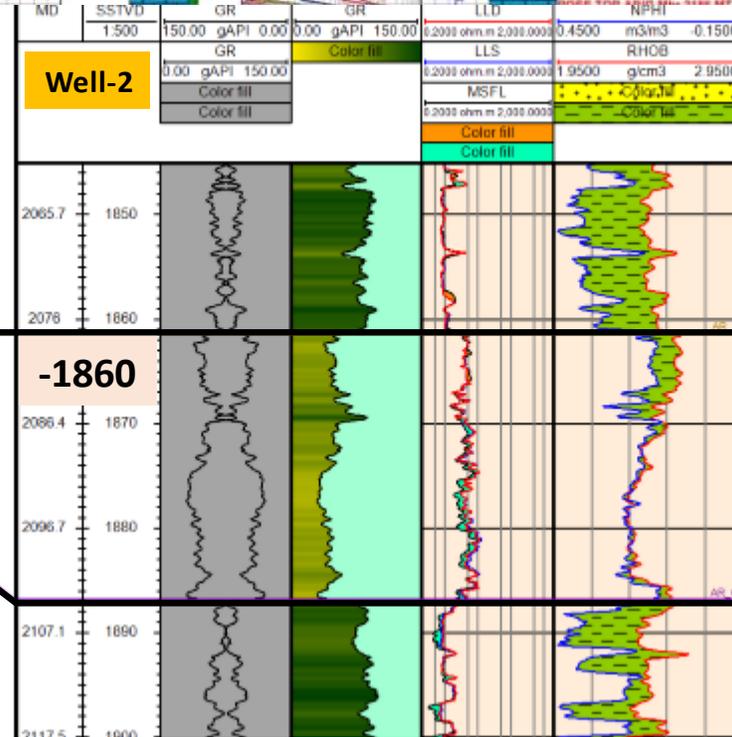
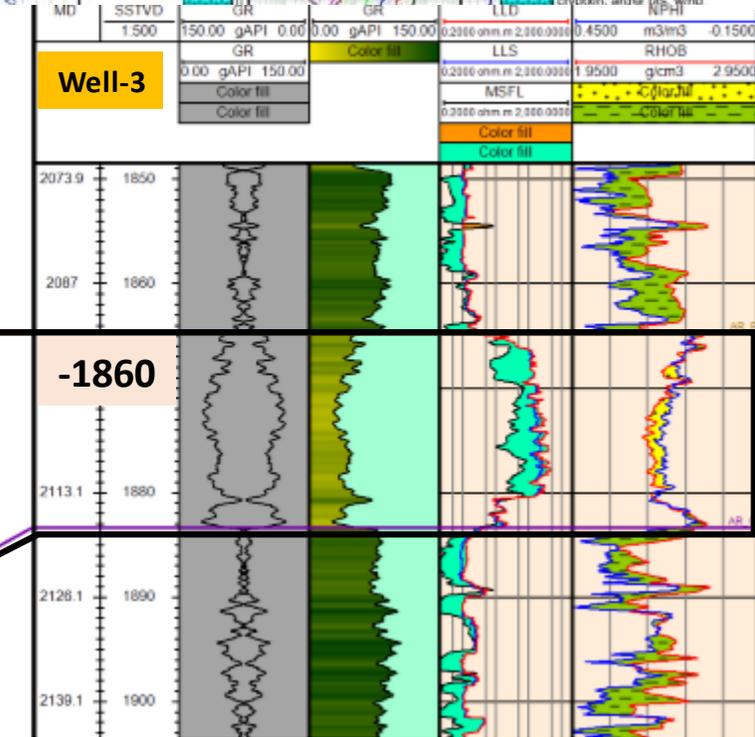
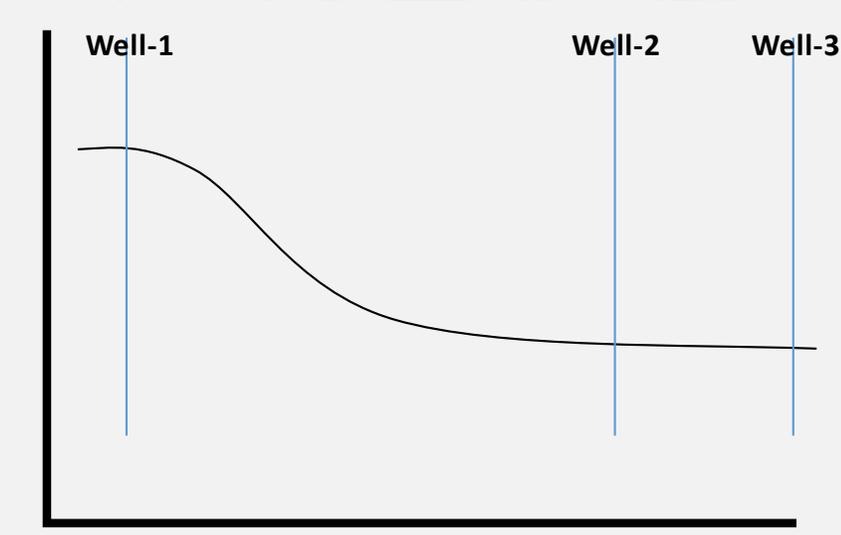
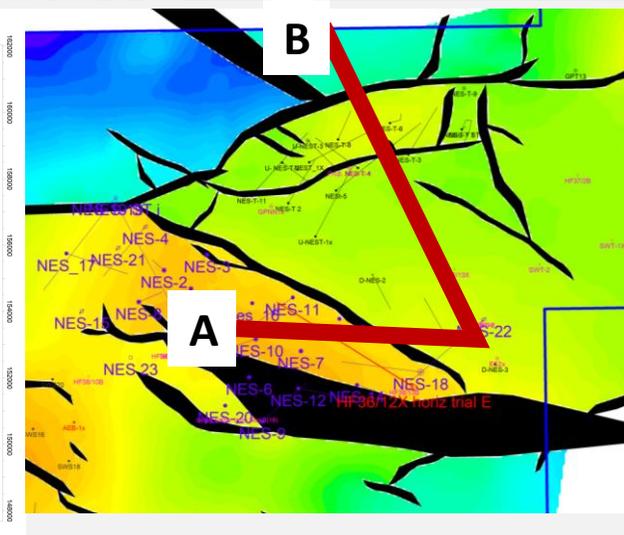
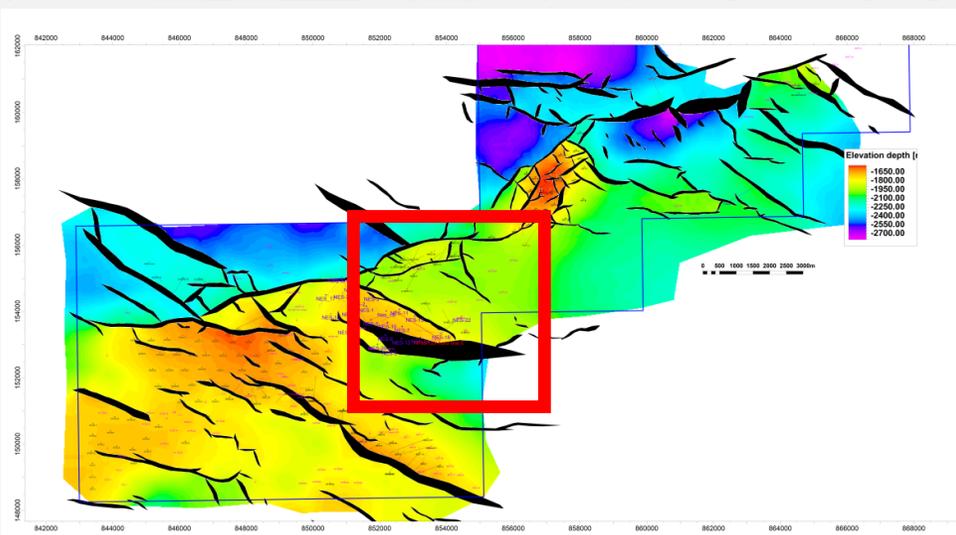
New level of knowledge

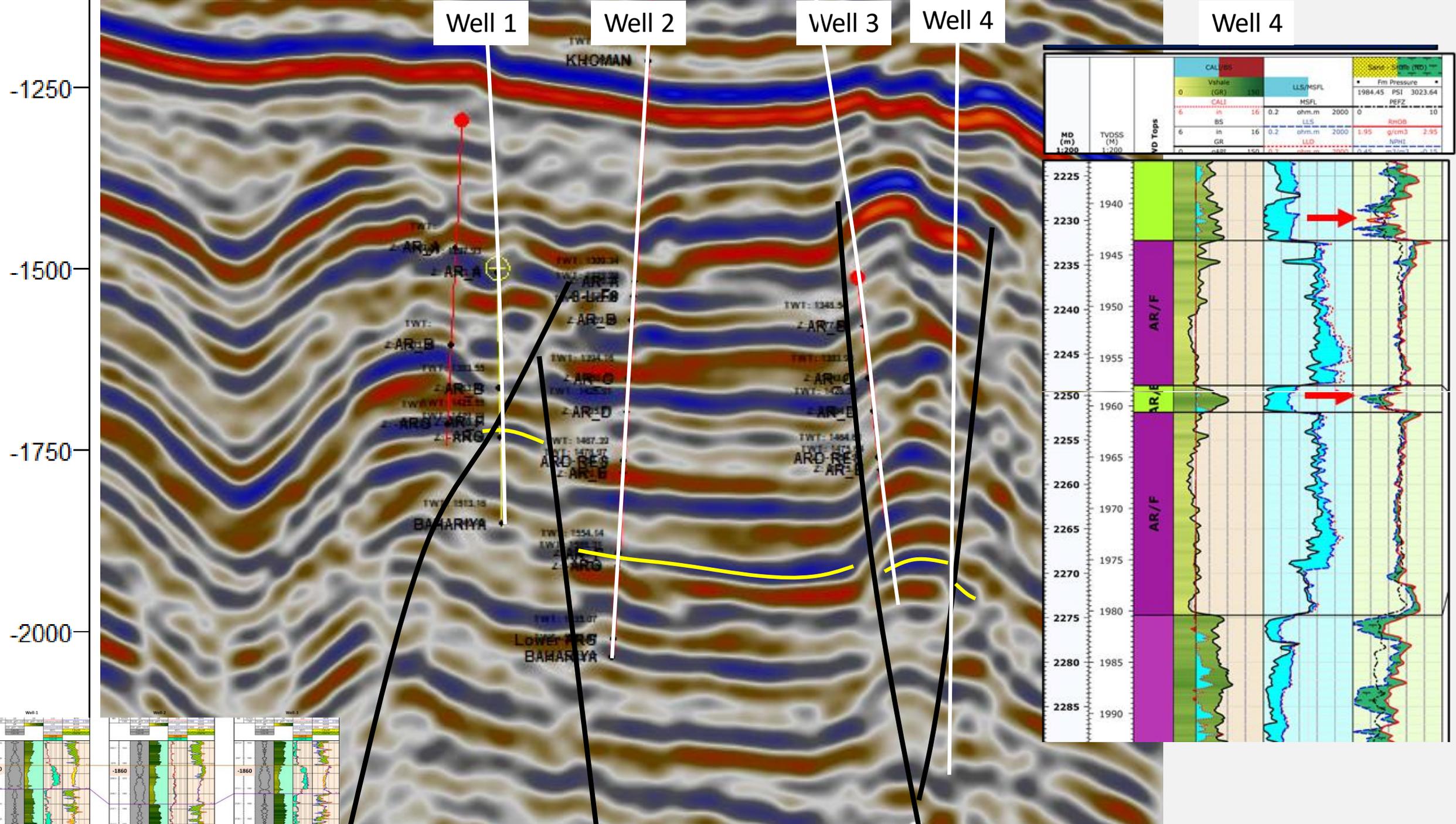
legacies

Production from AR/F

The Way to Evaluate ARF



A**-1680****Well-2****-1860****Well-3****-1860****B**



-1250

-1500

-1750

-2000

Well 1

Well 2

Well 3

Well 4

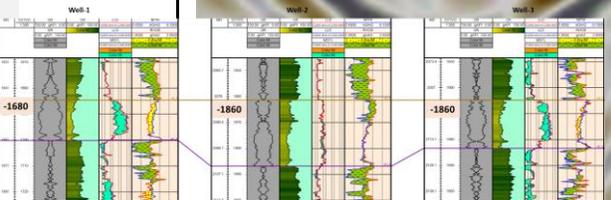
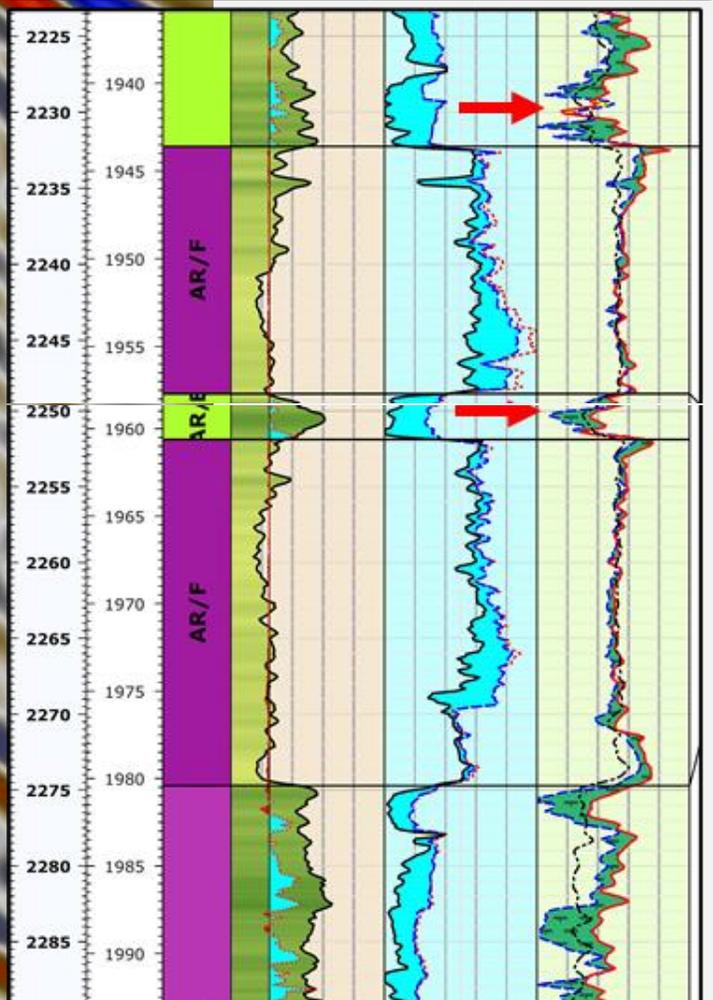
Well 4

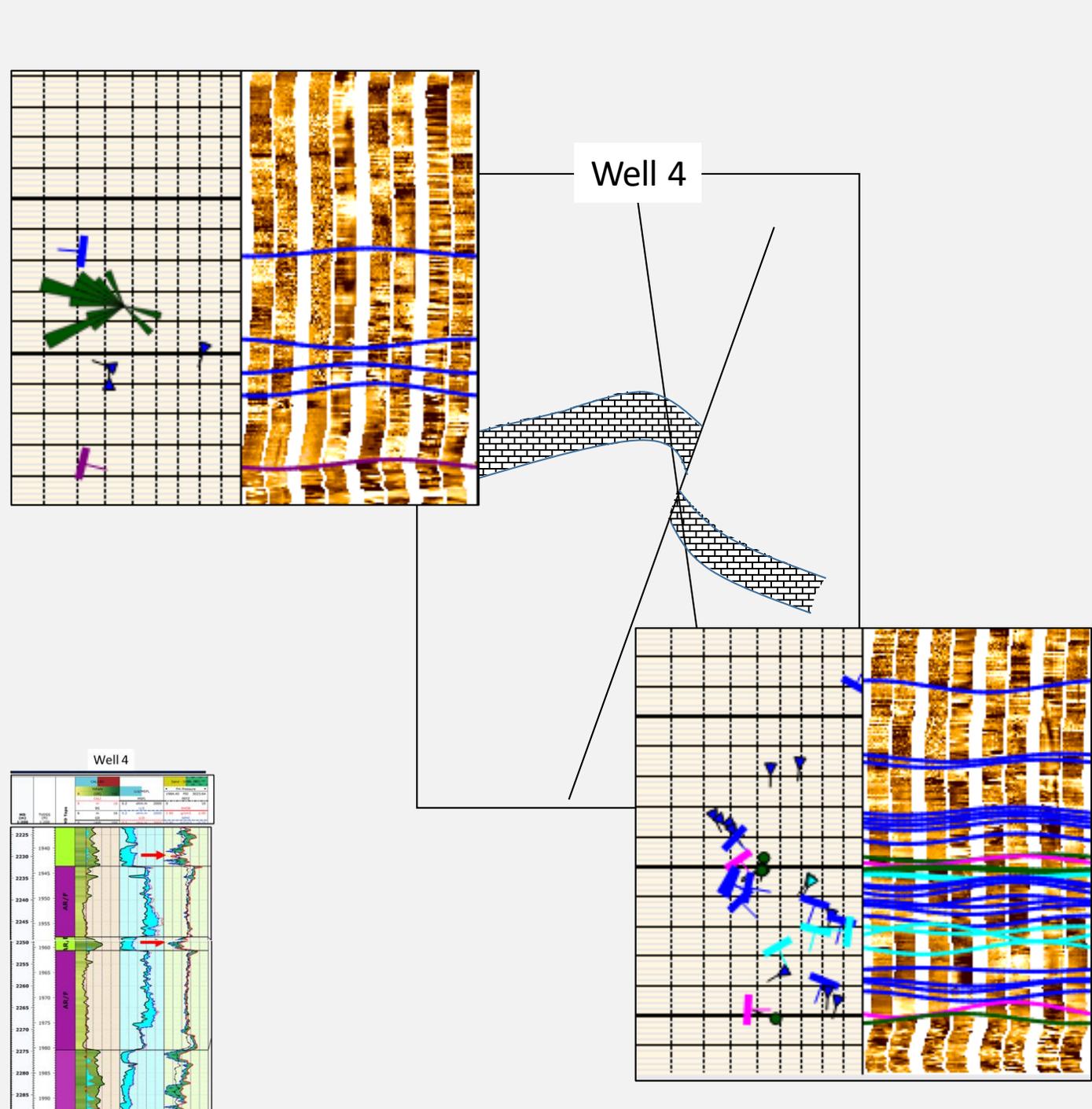
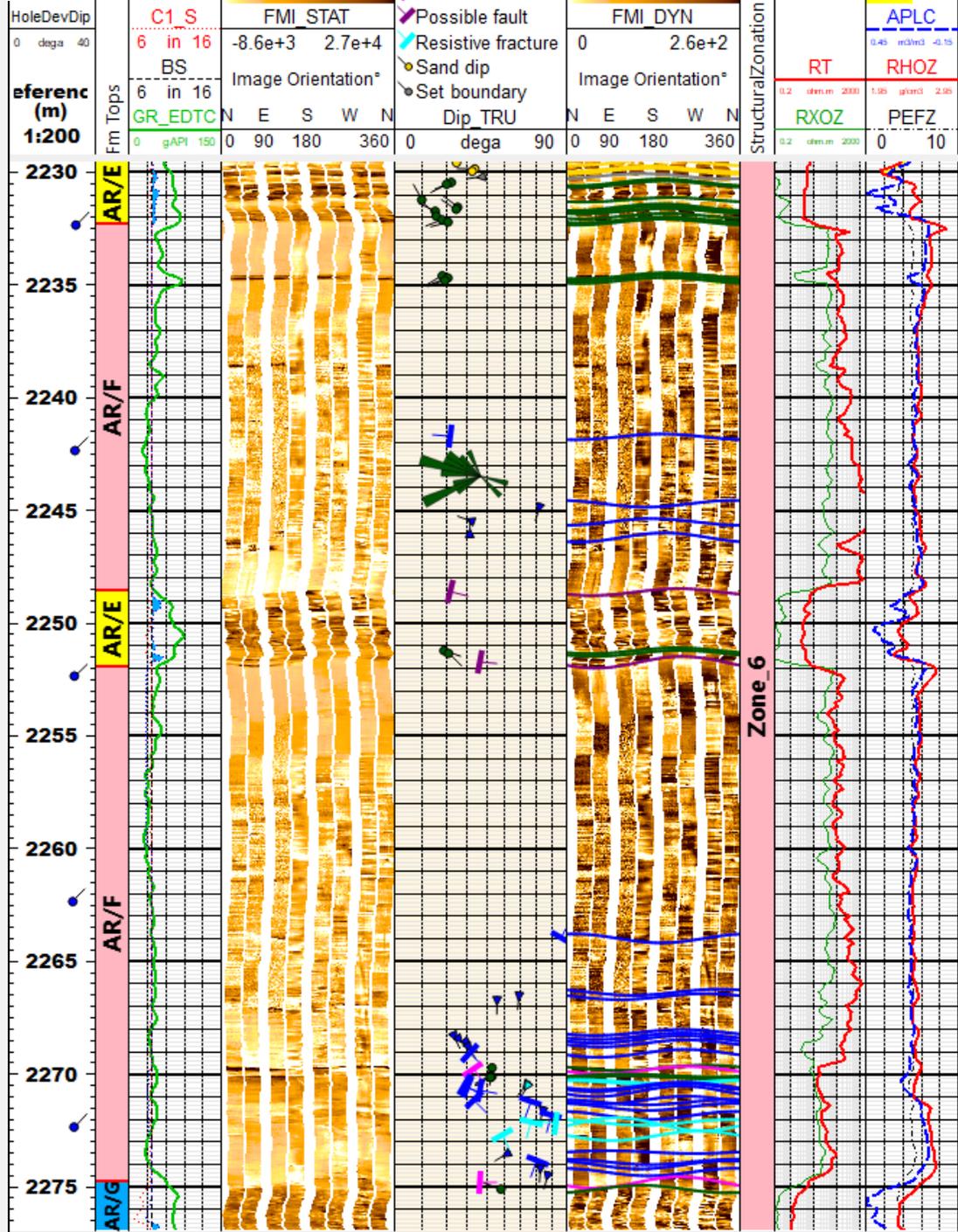
KHOVAN

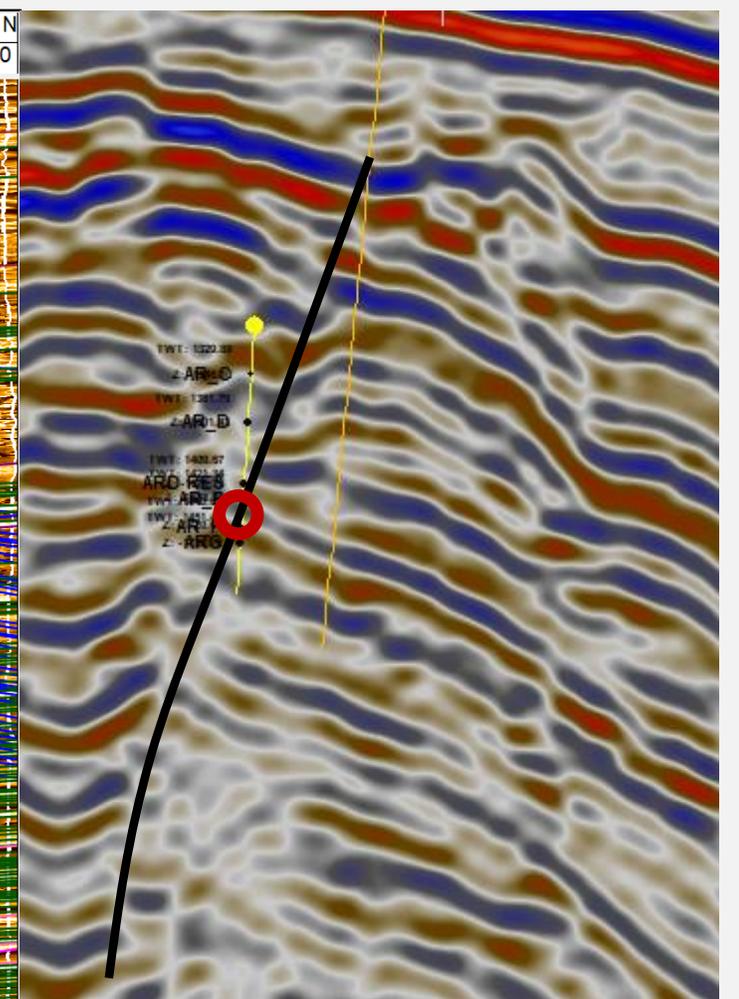
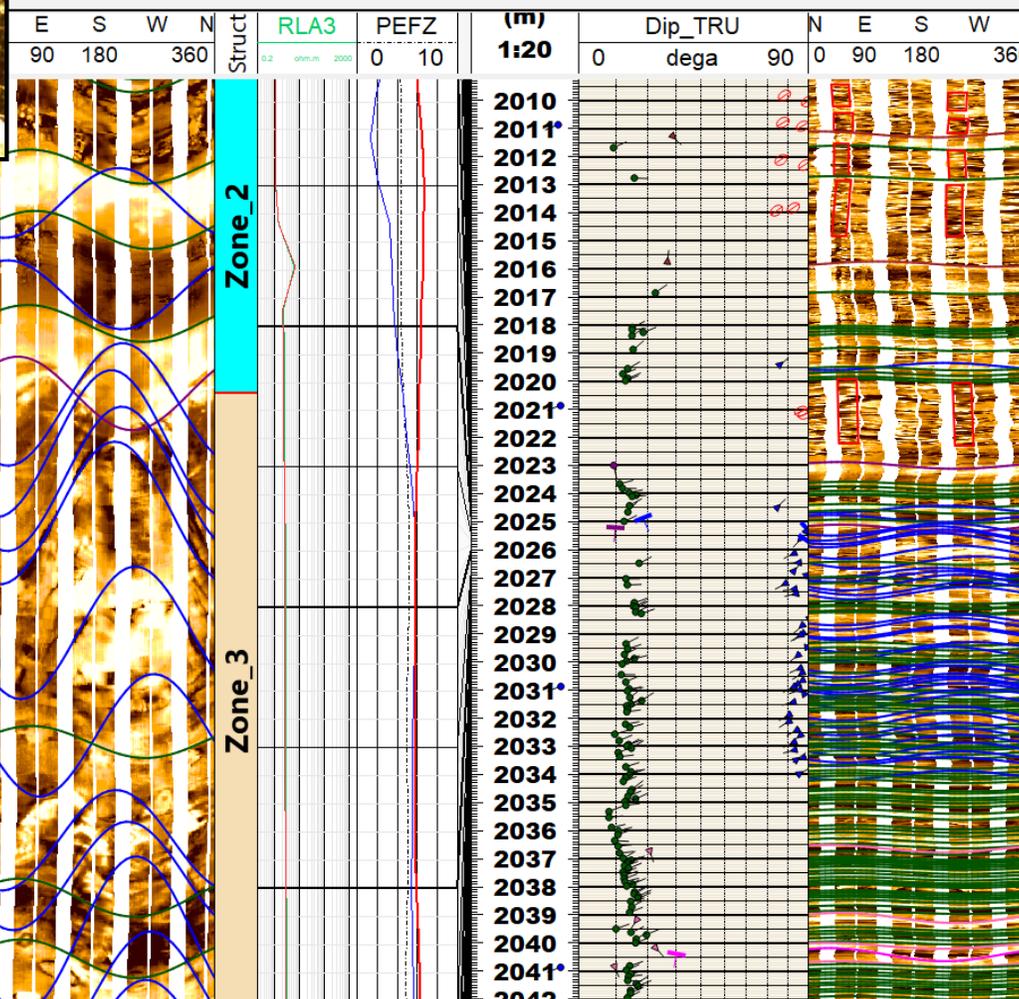
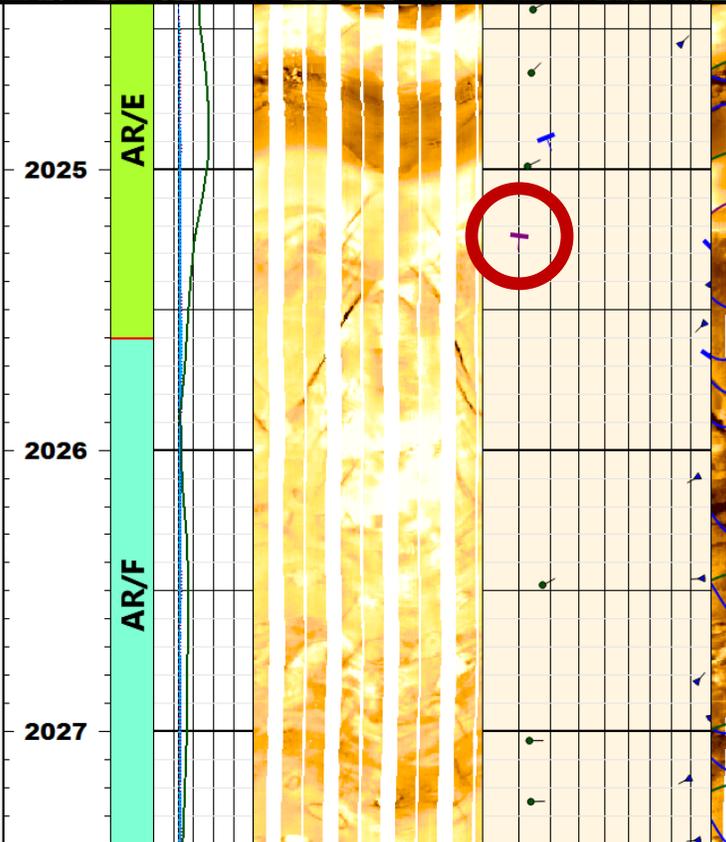
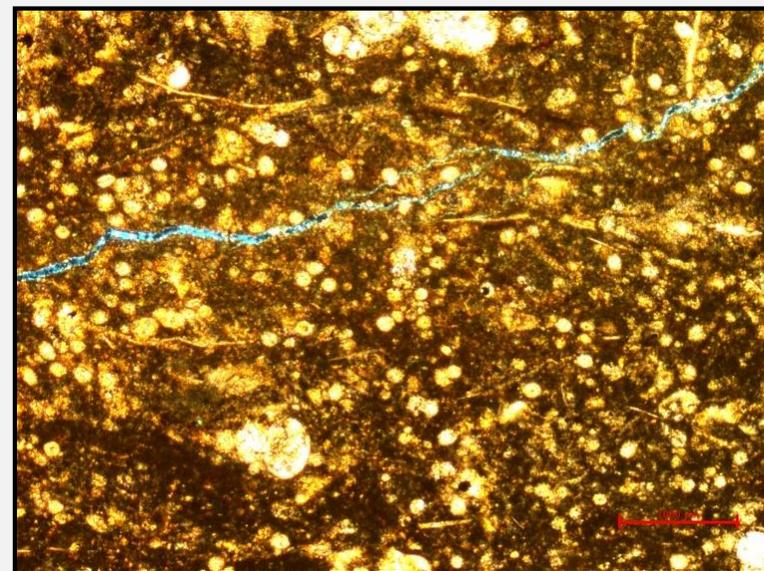
BAHARIYA

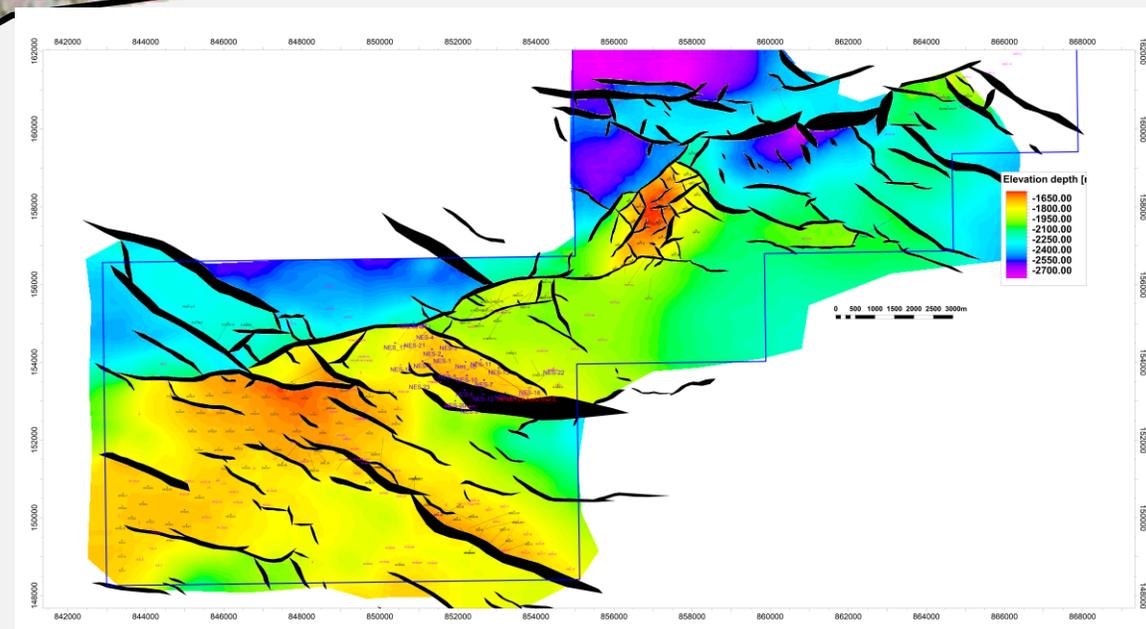
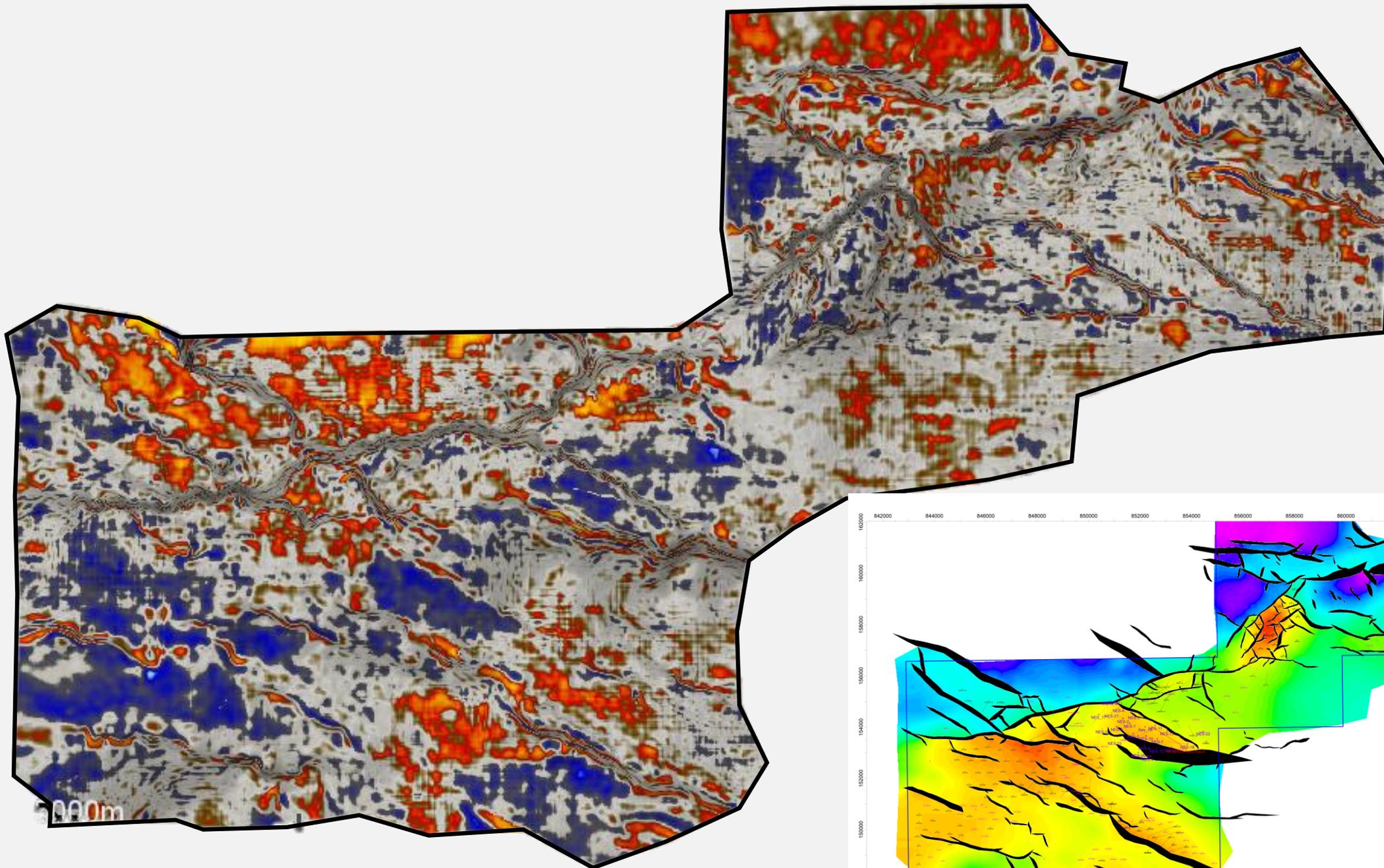
Lower FRS
BAHARIYA

MD (m)	TVDSS (M)	VD Tops	Well 4	Well 3	Well 2	Well 1
0	1984.45	MSFL	MSFL	MSFL	MSFL	MSFL
6	1984.45	MSFL	MSFL	MSFL	MSFL	MSFL
10	3023.64	MSFL	MSFL	MSFL	MSFL	MSFL

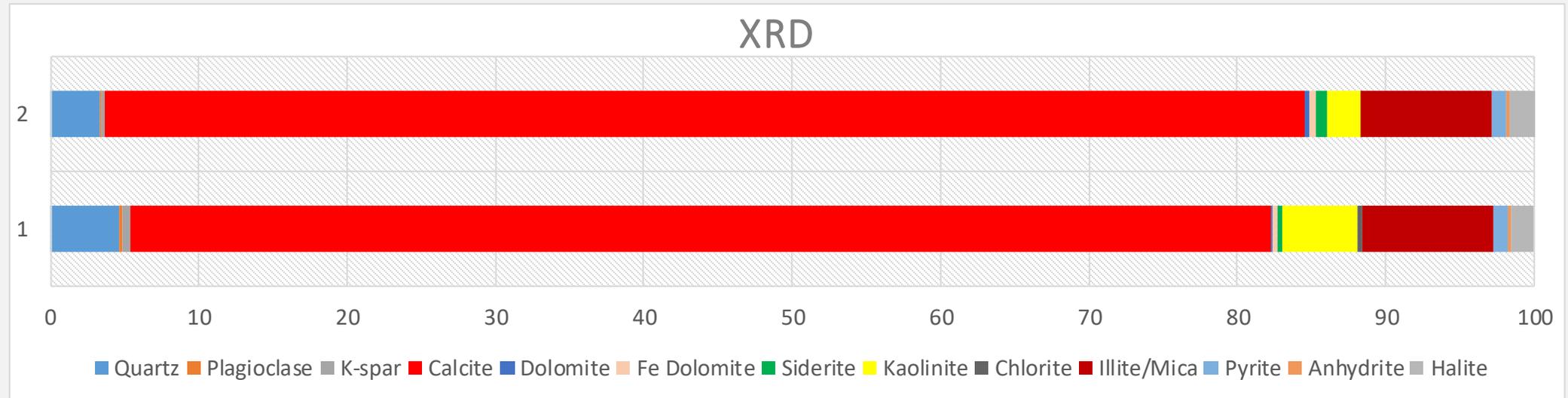








- Recently, two wells were and tested barefoot after acid stimulation



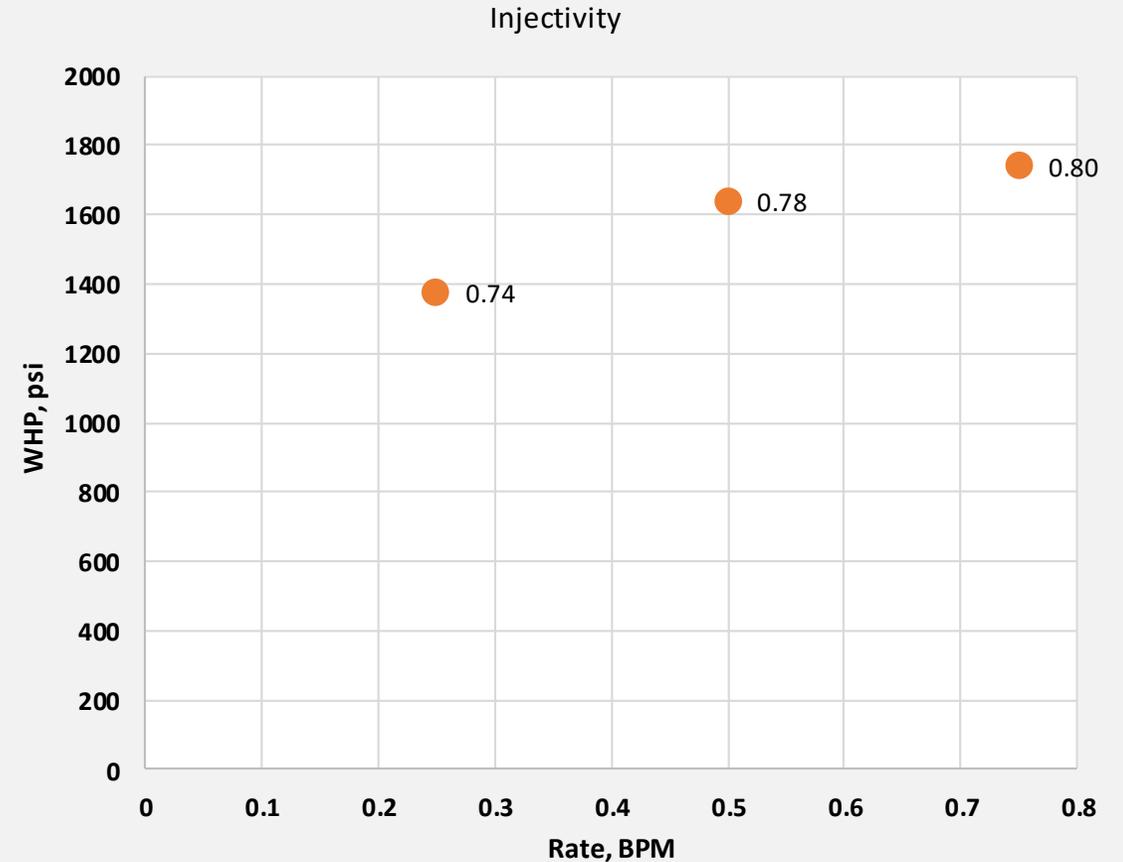
Solubility testing

	15% HCl	20% HCl
	77.88	78.78
	83.80	85.26
	84.31	89.71
	82.52	89.58

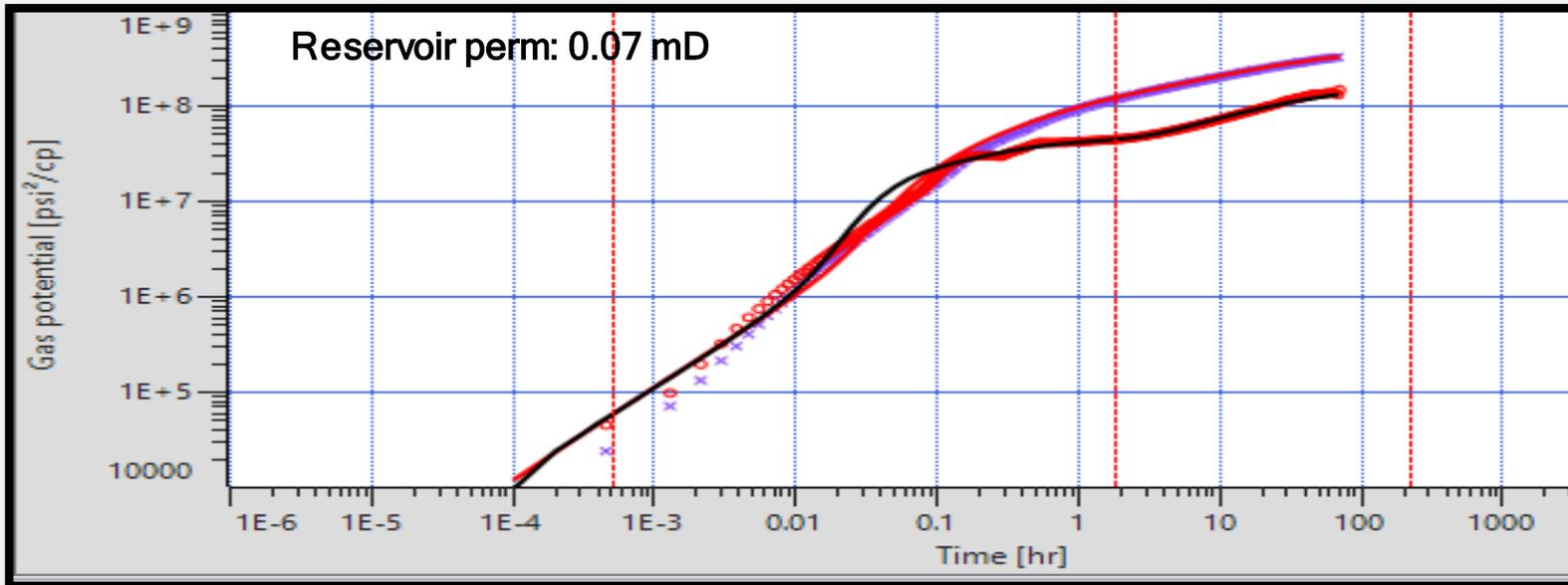
Well 1 Stimulation Review and Results

- Injectivity is showing normal matrix behavior
- Conventional acid stimulation was done
- WHP decreased from 1700 to 985 psi at the end of job .

Duration , hour	Choke Size	Well head Pressure	Oil Gravity	BS&W	Oil Rate	Gas Rate
	Inch	psig	°API	%	STB/D	MMSCF/ D
15	1/2	371	-	0	0	0.860
24	3/4	269	-	0	0	1.281

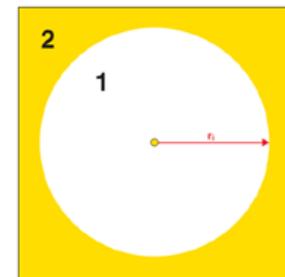
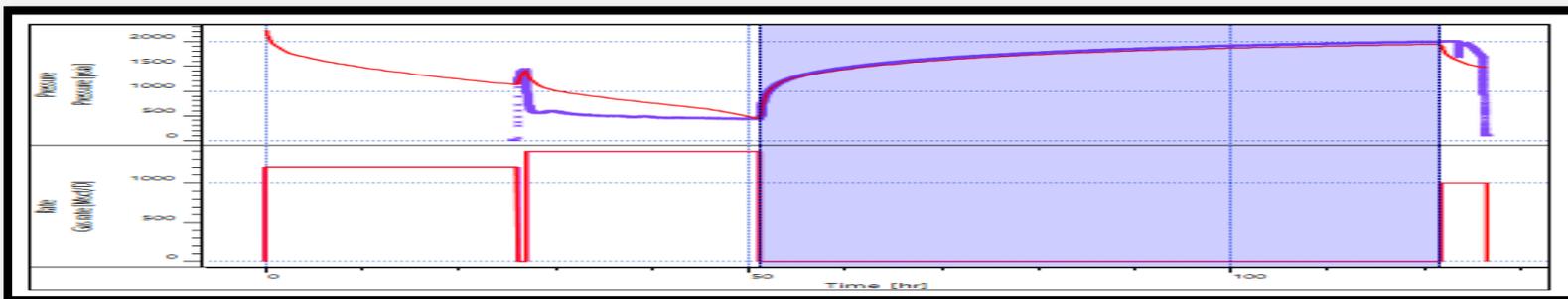


Well 1 Well Test Interpretation



Wellbore = Changing hegeman
 Well = Vertical
 Reservoir = Radial composite
 Boundary = Infinite

$P_i = 2295.87$ psia
 $kh = 11.9305$ md.ft
 $k = 0.244212$ md
 $\Delta t = 0.120064$ hr
 $C_f = 0.0348717$ bbl/psi
 $C_i = 0.163897$ bbl/psi
 $Skin = -3.22289$
 $R_i = 44.0332$ ft
 $M = 3.33083$
 $D = 3.52229$

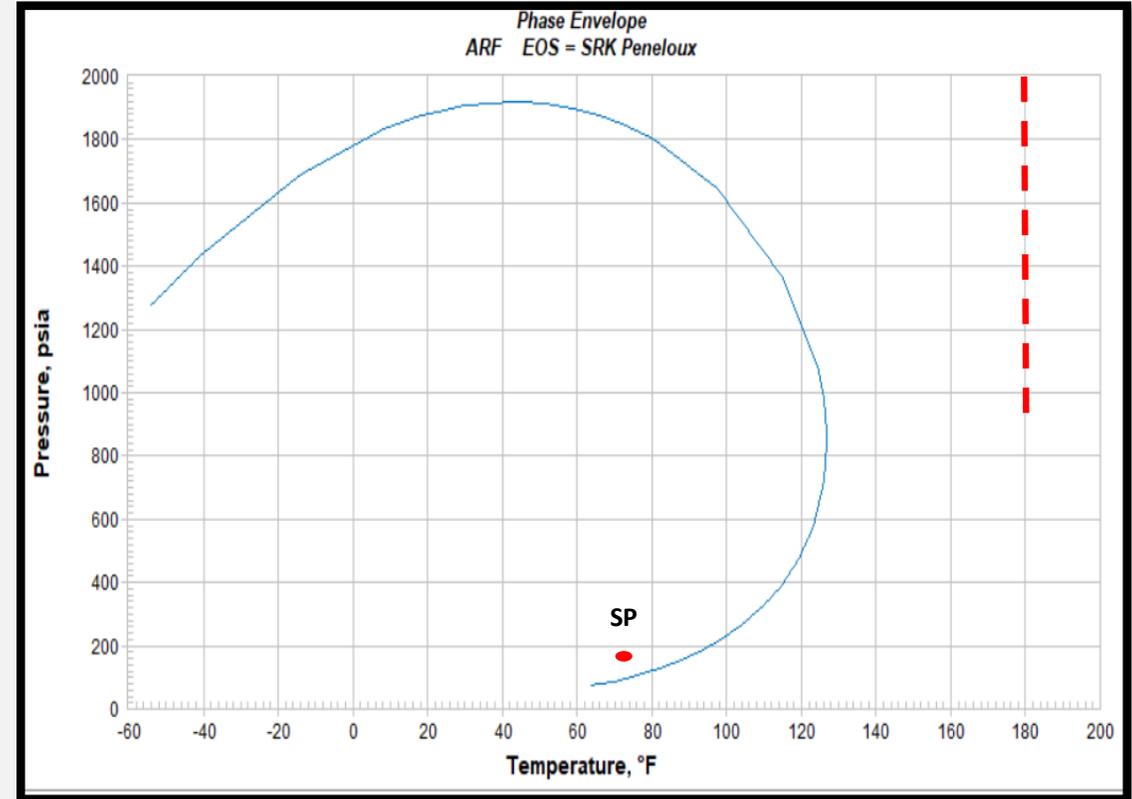
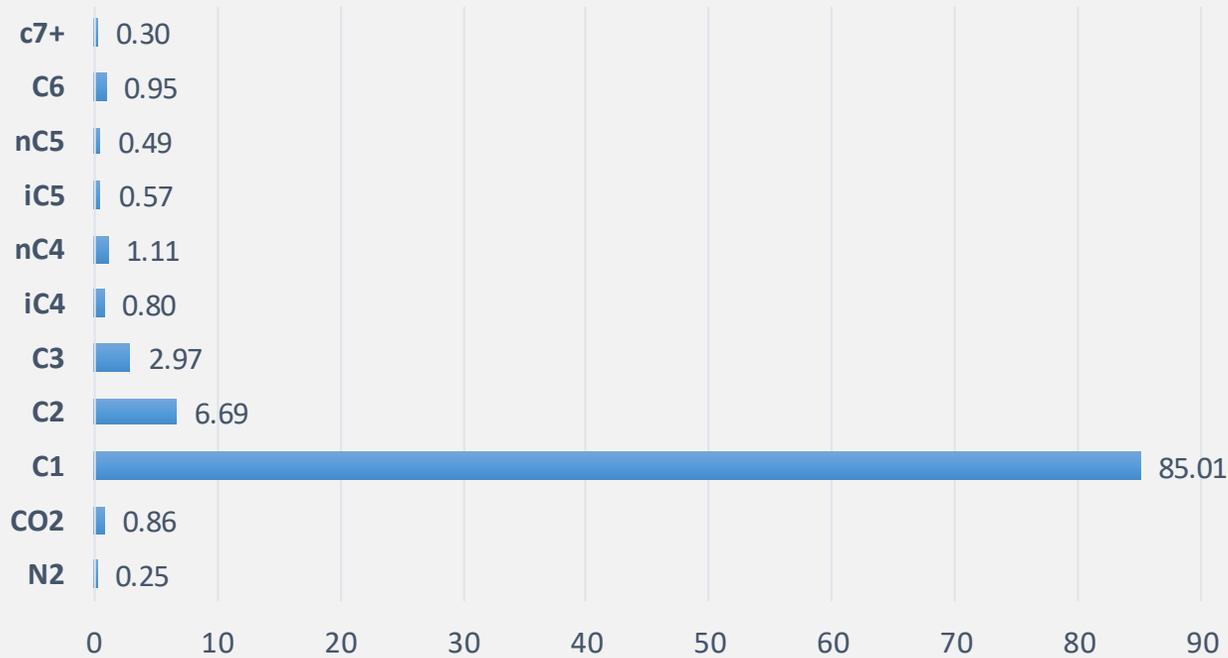


Radial Composite Reservoir

Fluid Composition

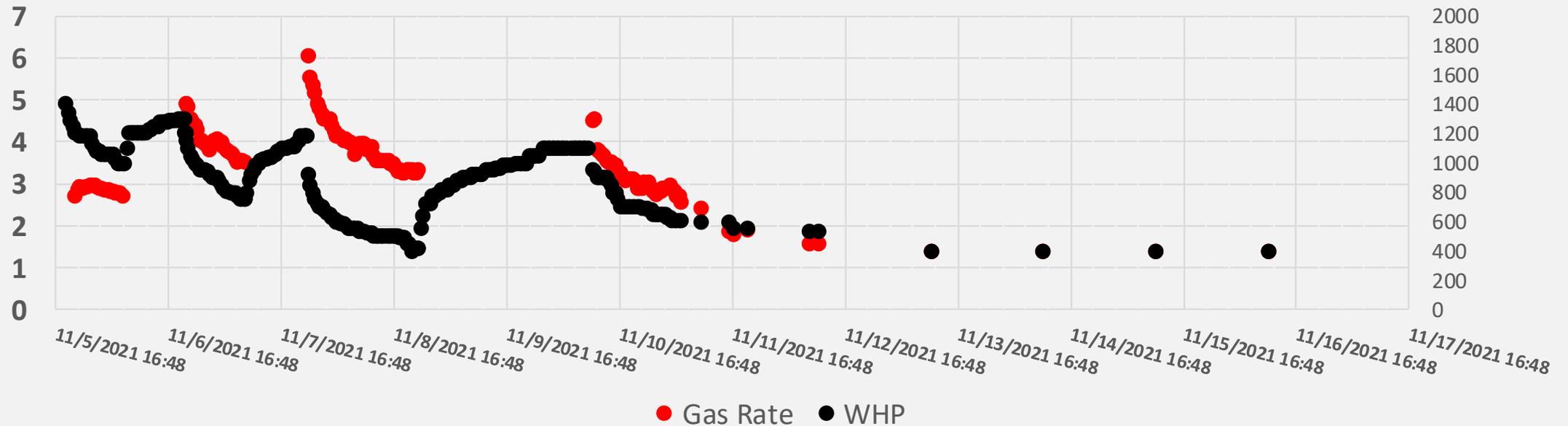
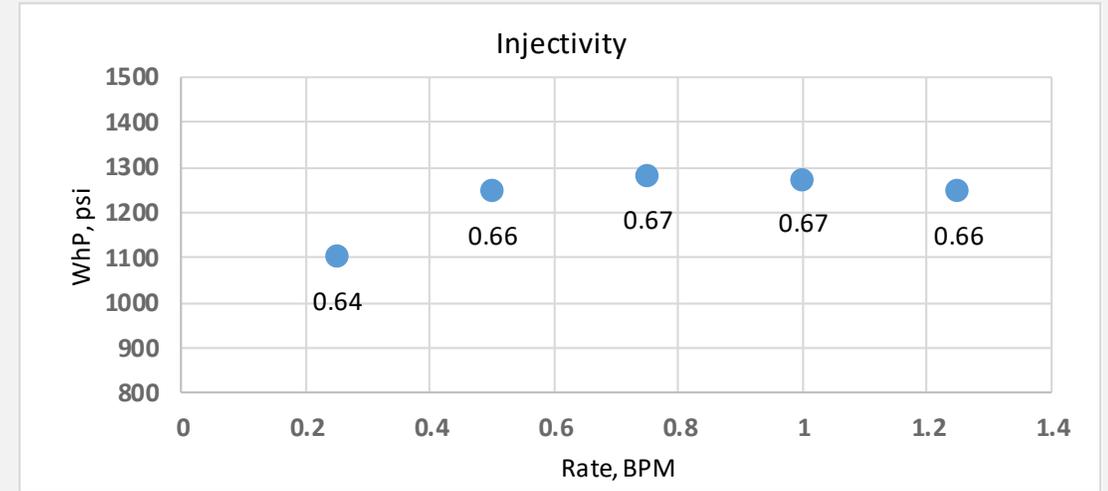
- ARF Fluid is considered as a wet gas with CGR 3 STB/MMSCF
- Gas gravity : 0.7
- Condensate API : 65

Composition mole %

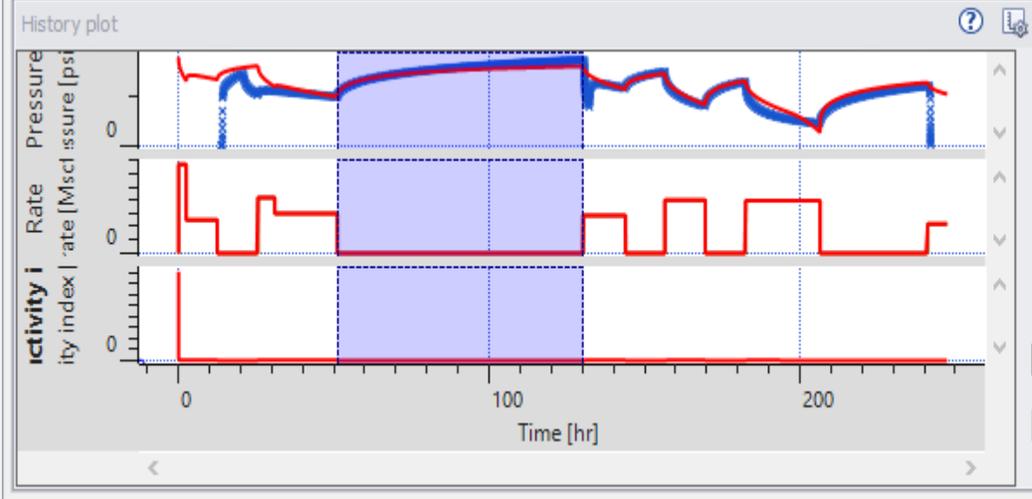
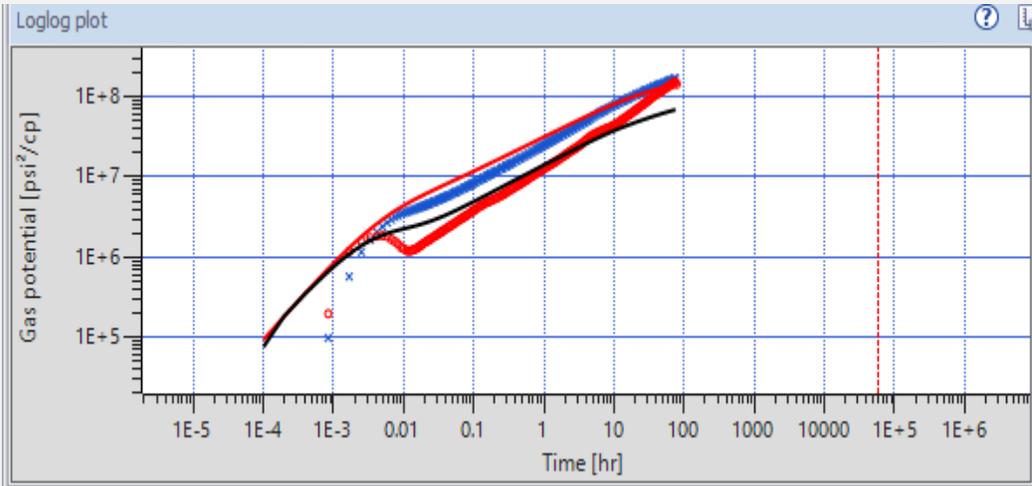


Well 2 Stimulation Review and Results

- **Injectivity is showing presence of some natural fractures**
- **VDA, MSR & Emulsified Acid (SXE)** were used to improve acid stimulation performance
- Press. dropped from 1350 psi T/ 350 psi once SXE Entered FM then to zero.

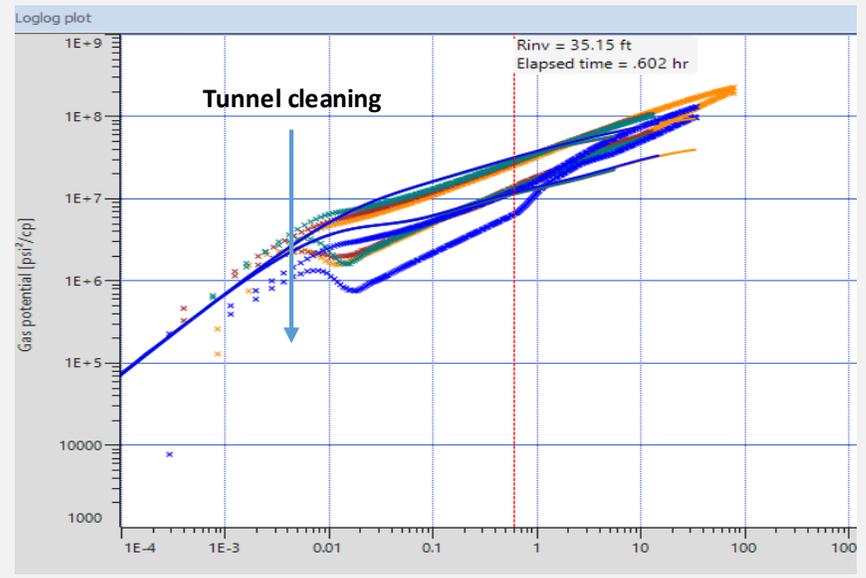


Well 2 Well Test Results

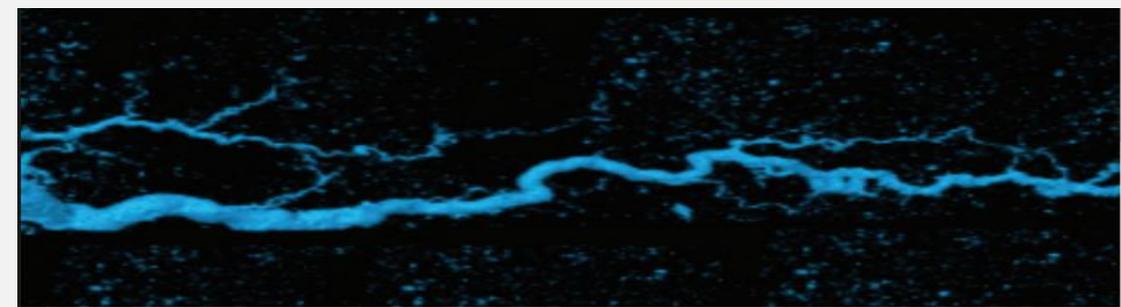


Wellbore = Constant
 Well = Vertical fractured infinite cond
 Reservoir = Homogeneous
 Boundary = Infinite

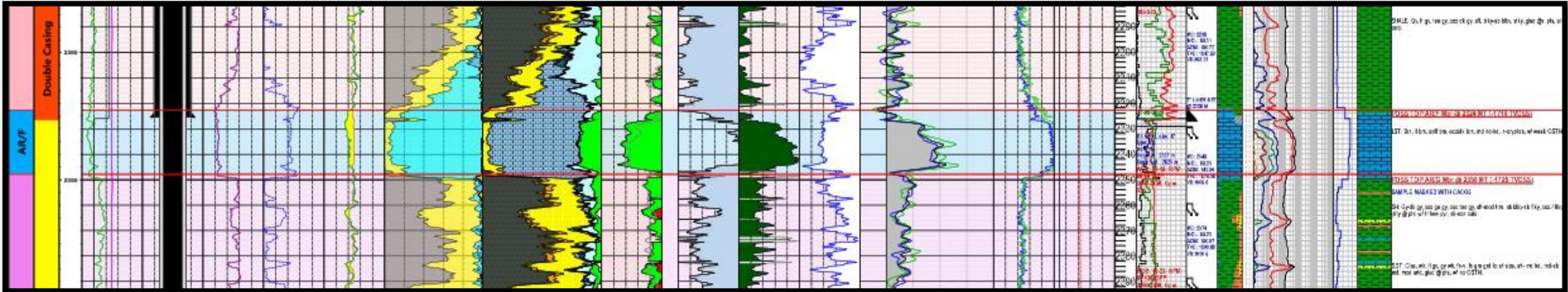
Pi = 1785.92 psia
 kh = 5.31226 md.ft
 k = 0.0793101 md
 C = 0.0465405 bbl/psi
 Skin (Fracture) = 50.0000
 Xf = 204.739 ft



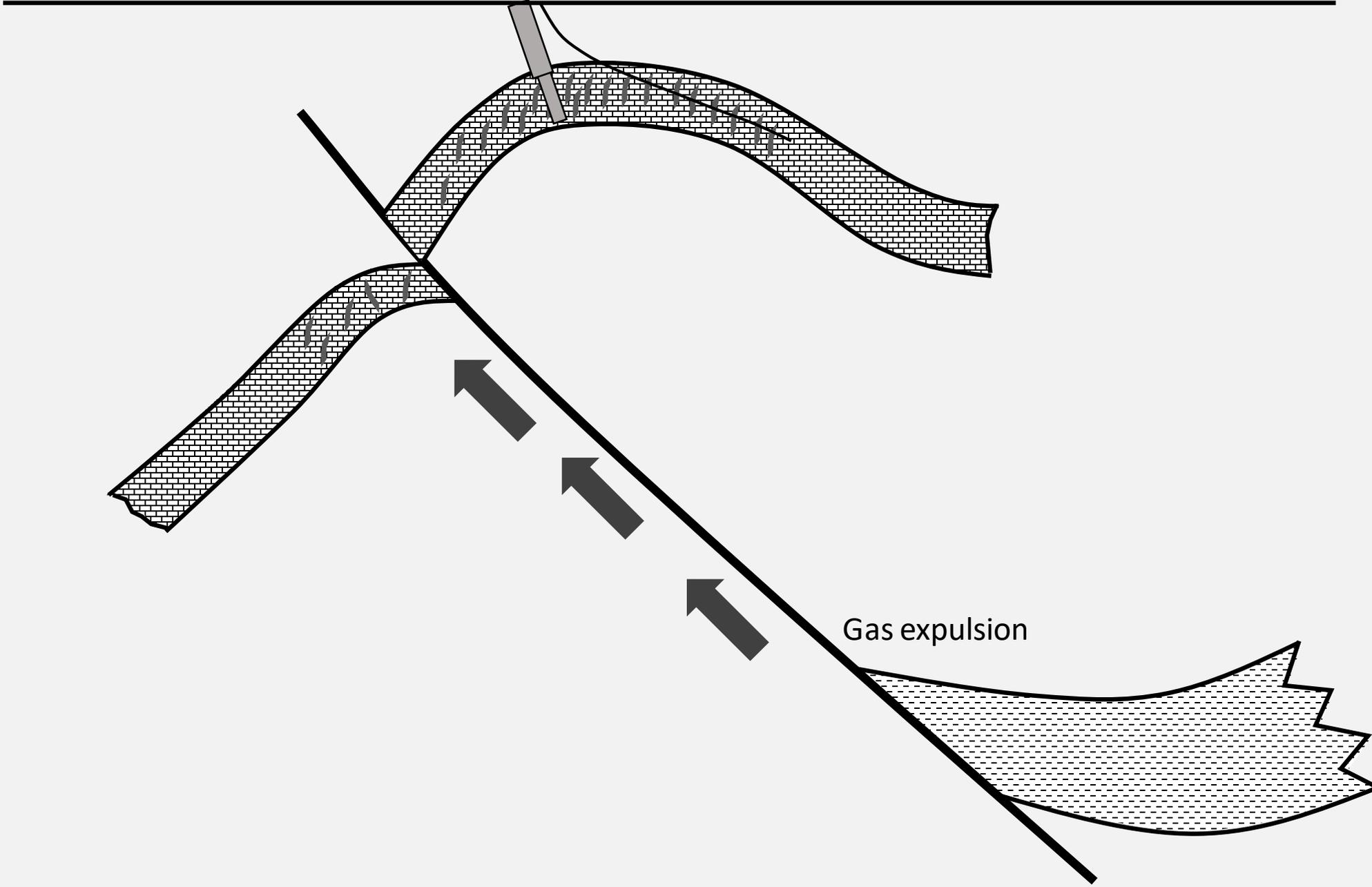
SXE Acid



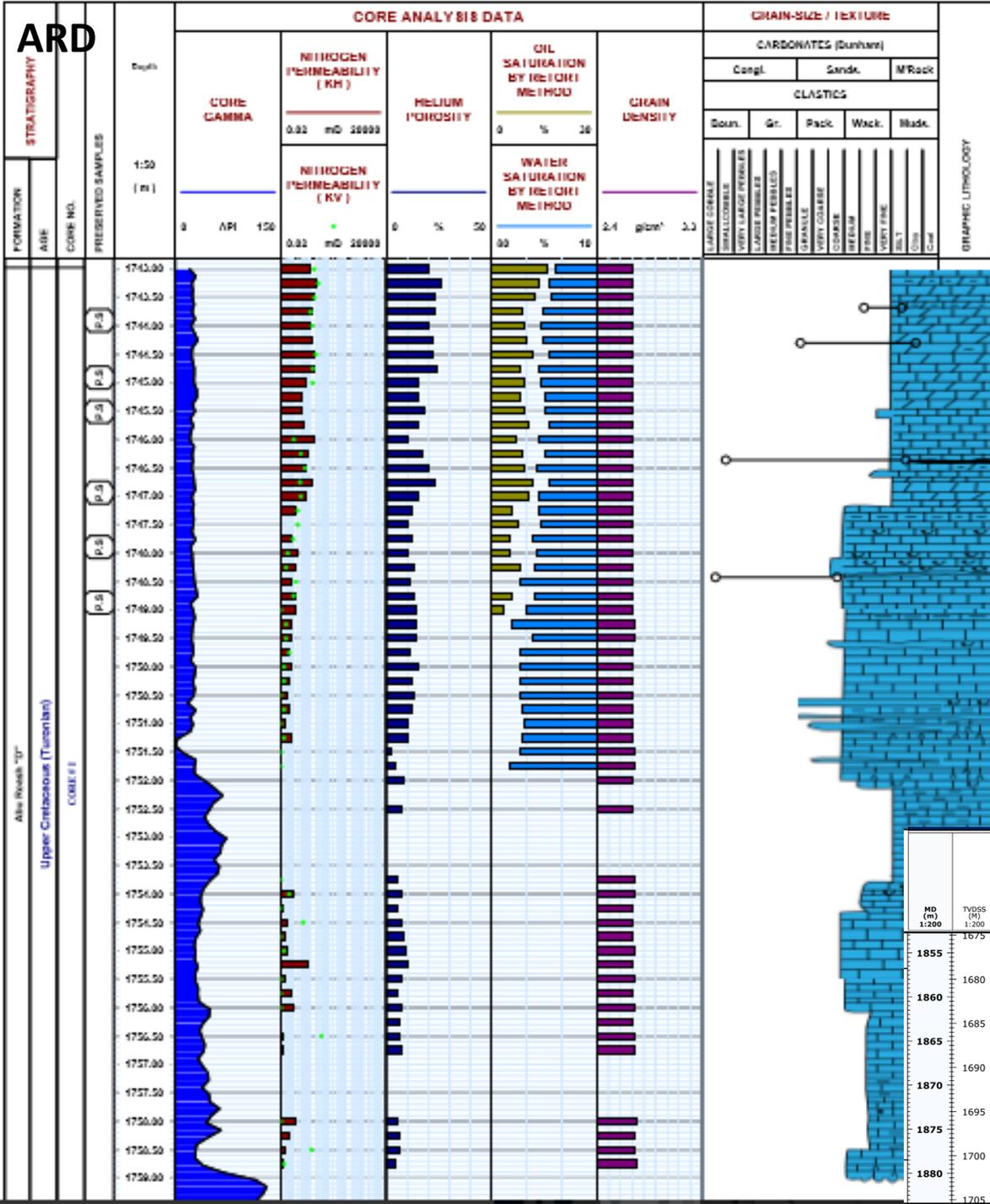
PNX Results



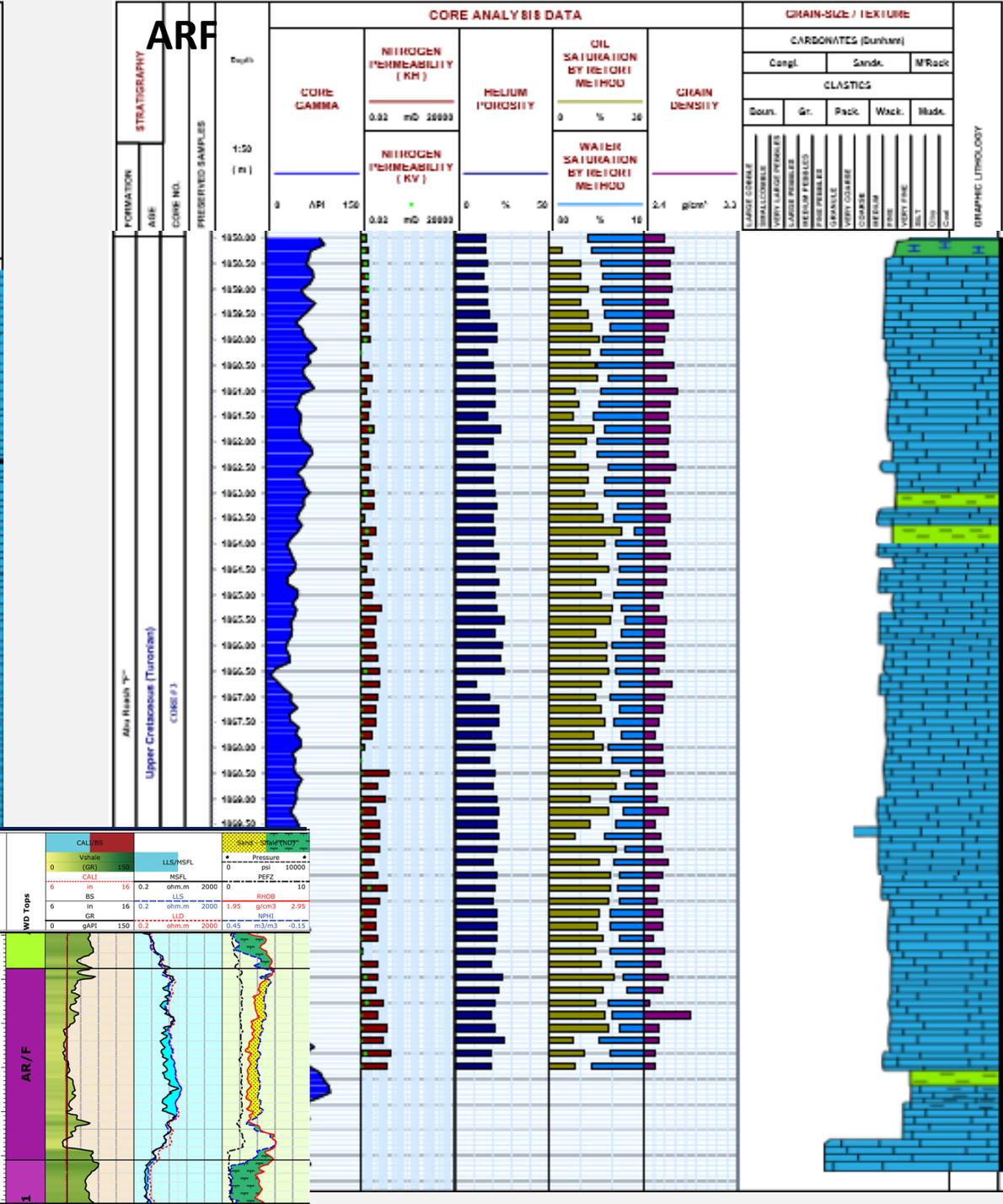
- AR/F appears to have a very large TOC content, which is interpreted to be most likely Kerogen. However, there is a possibility of it including some hydrocarbon due to the observed FNXS being slightly lower than the expected FNXS for Kerogen.

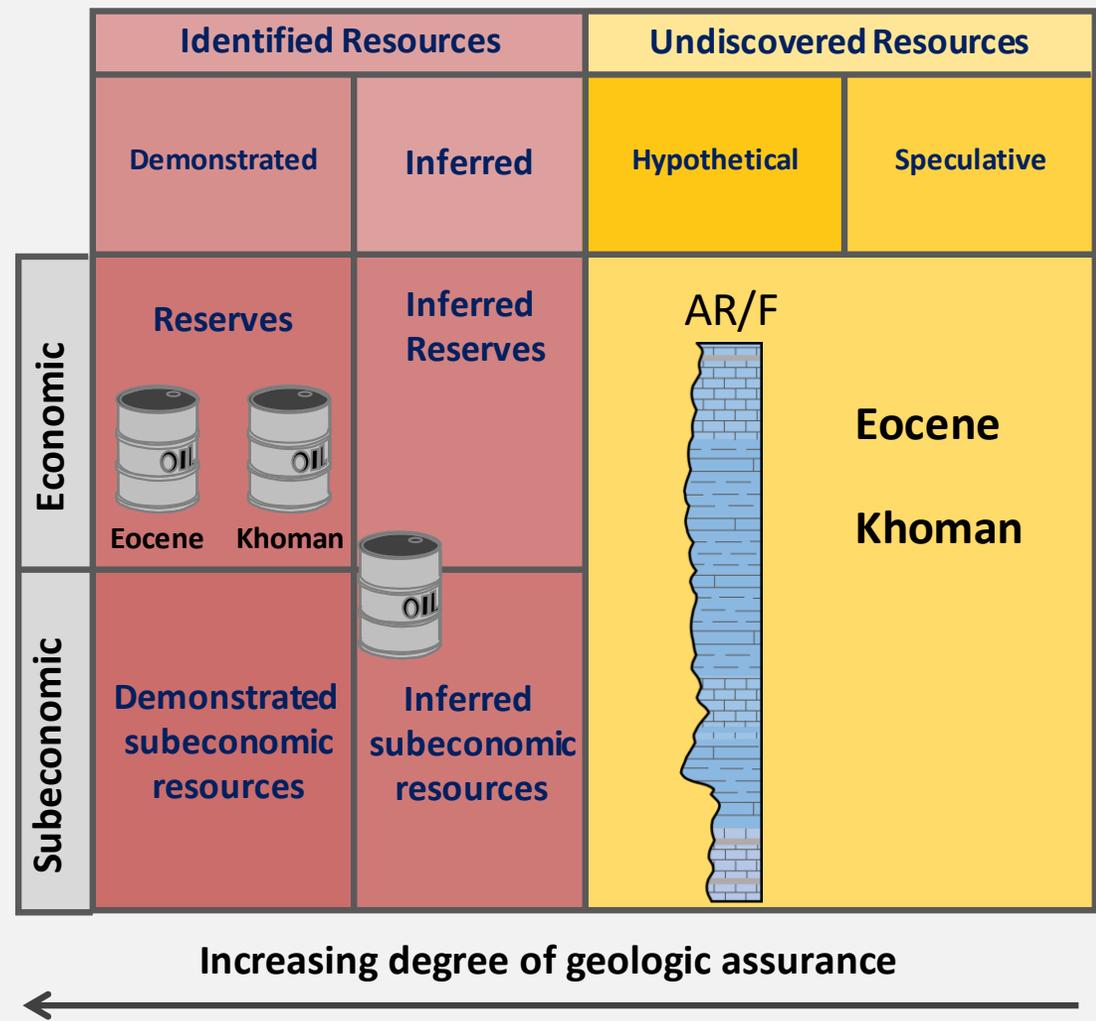
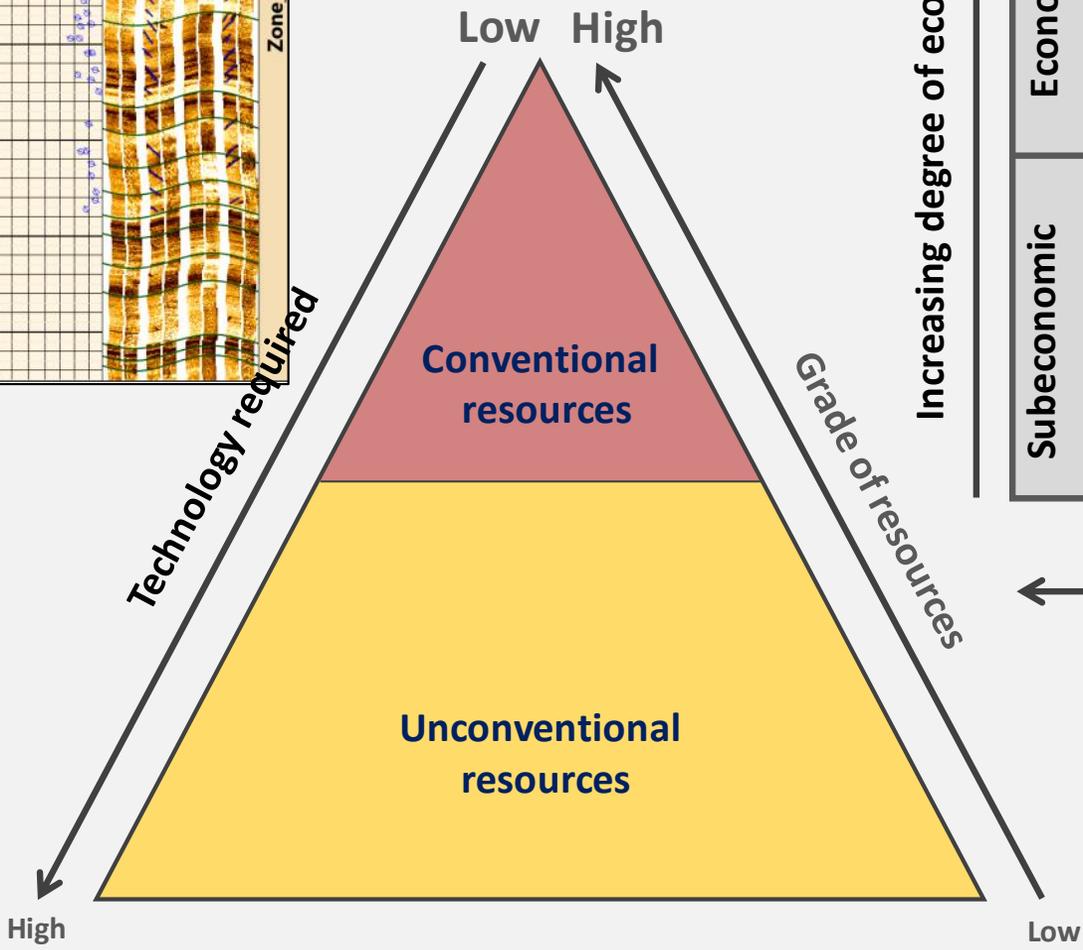
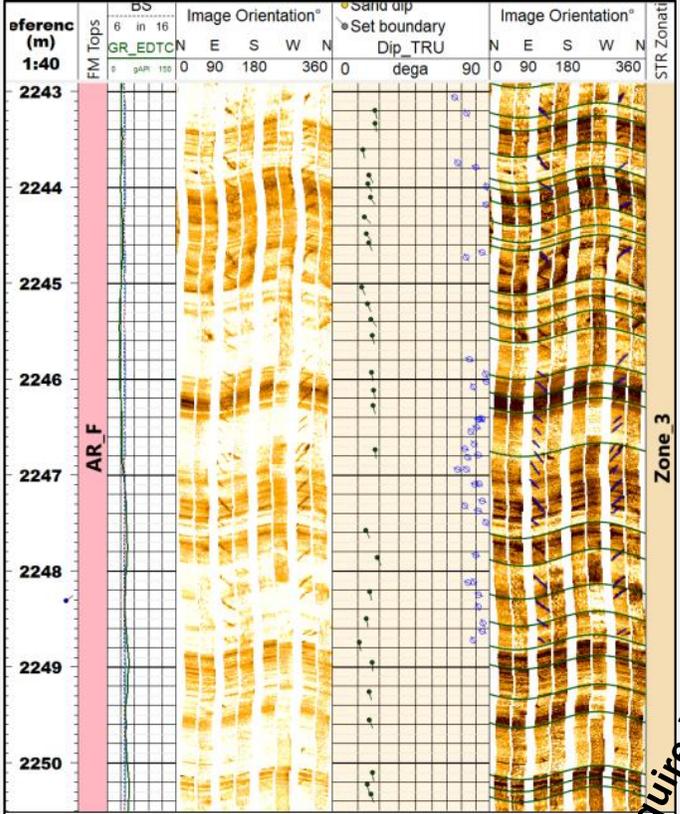


ARD



ARF

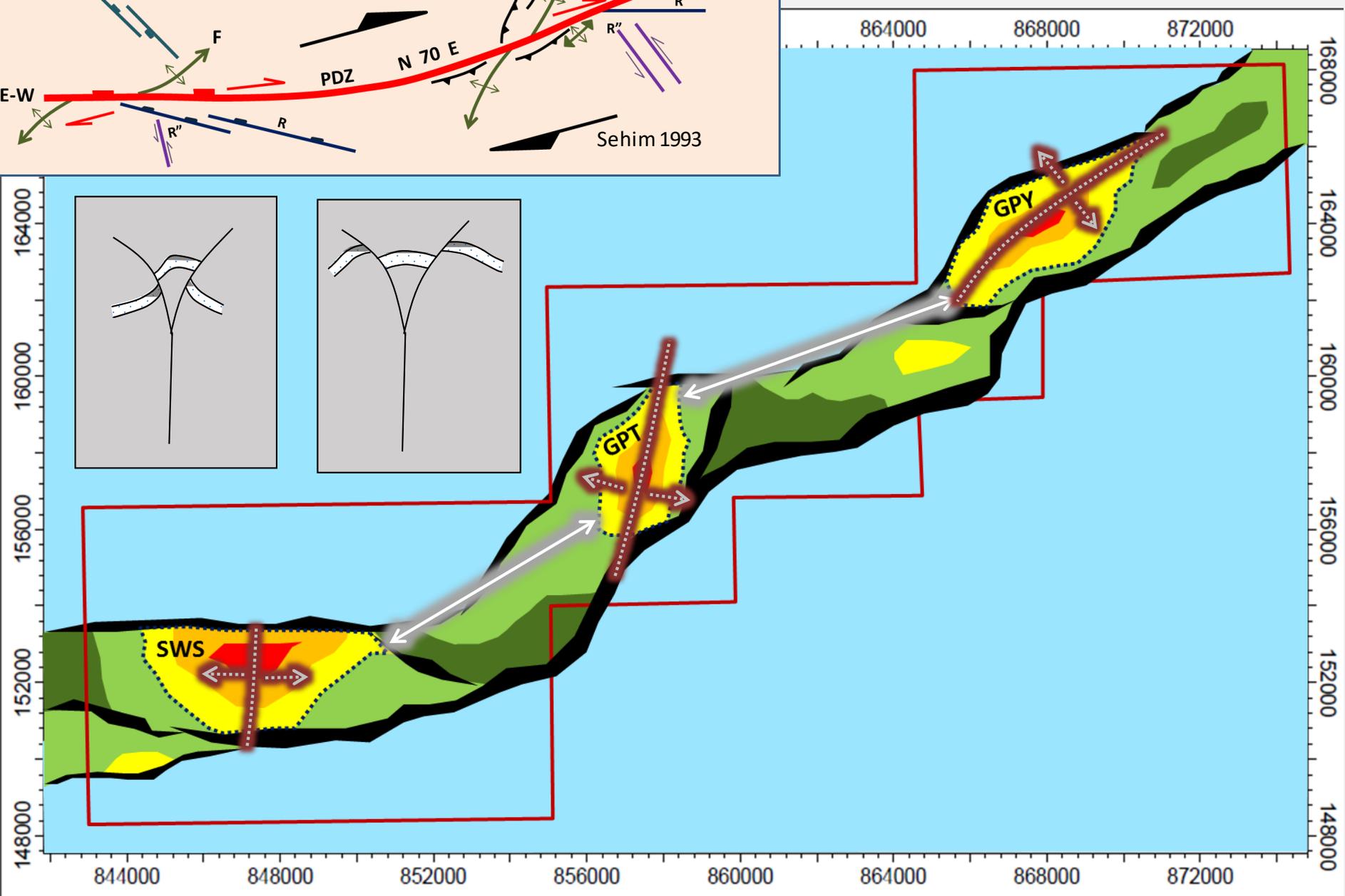
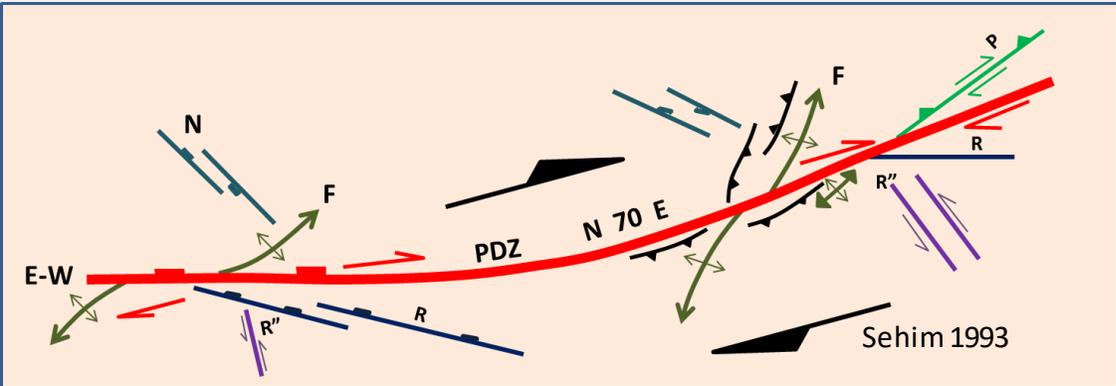


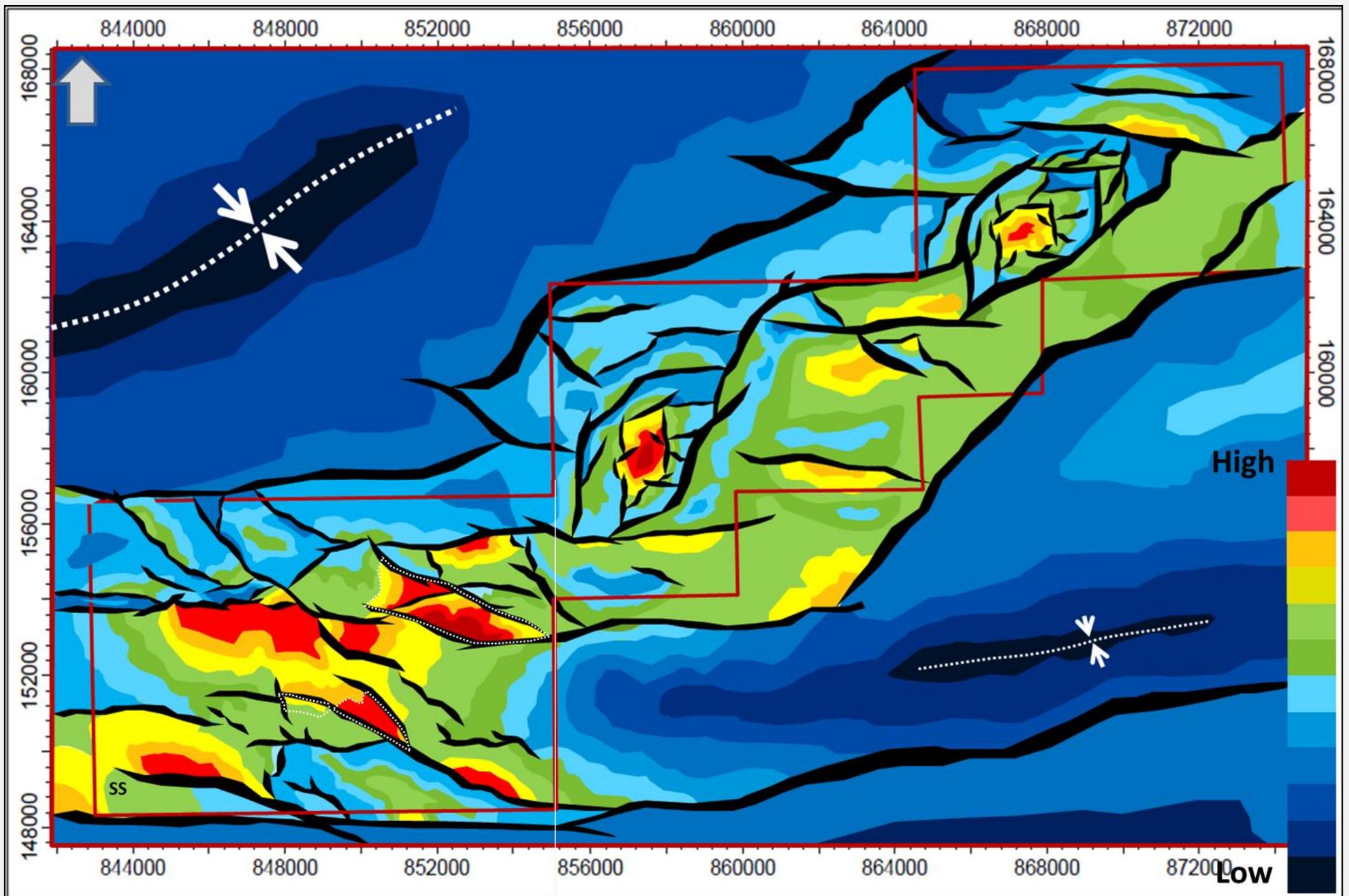


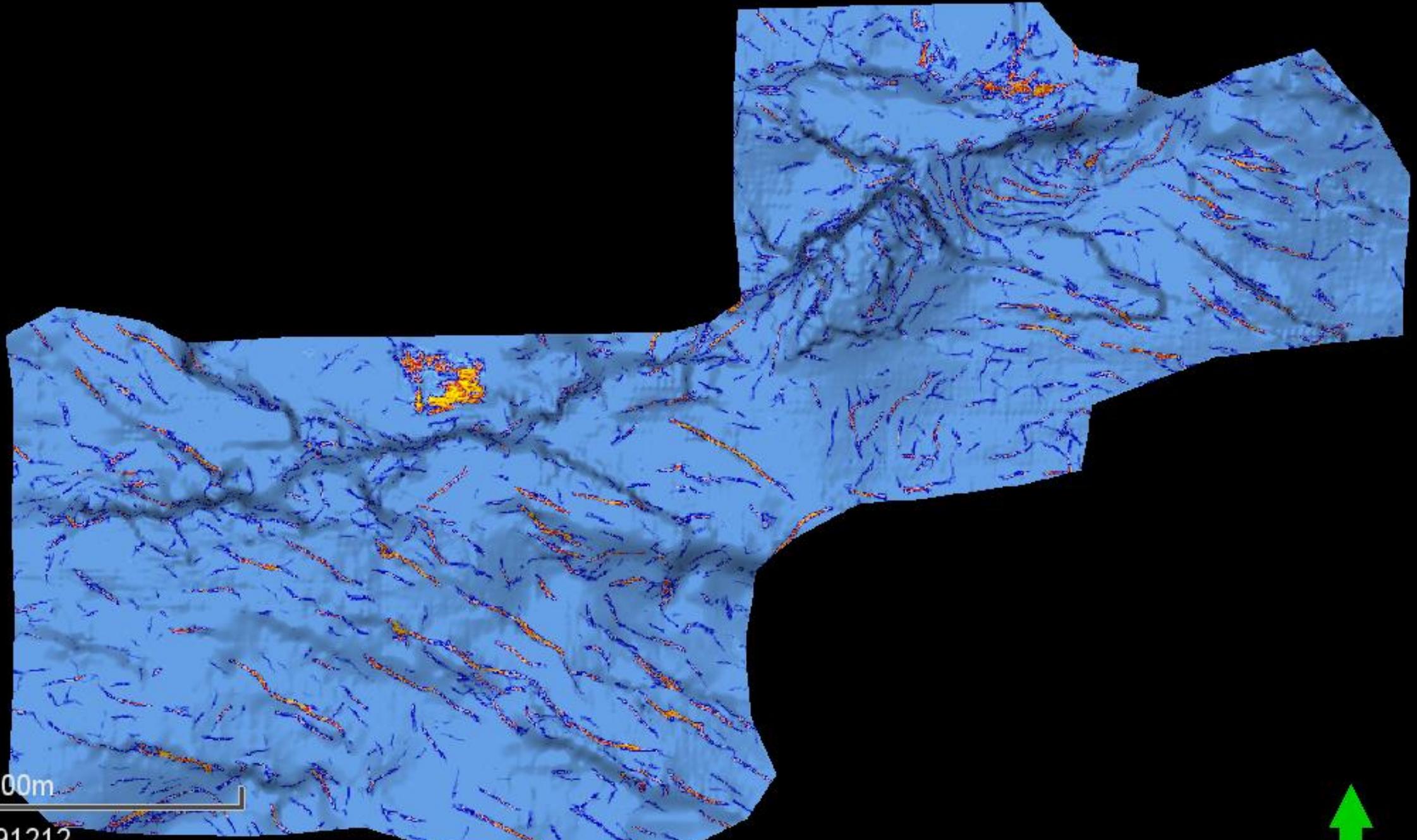
The Mckelvey diagram (after Mckelvey, 1972)

Thank You!





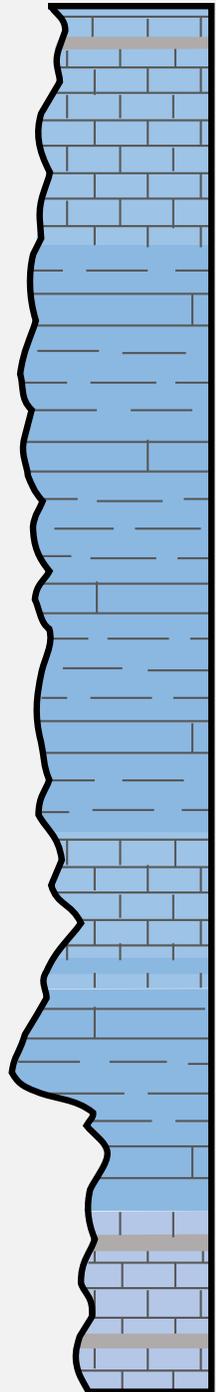
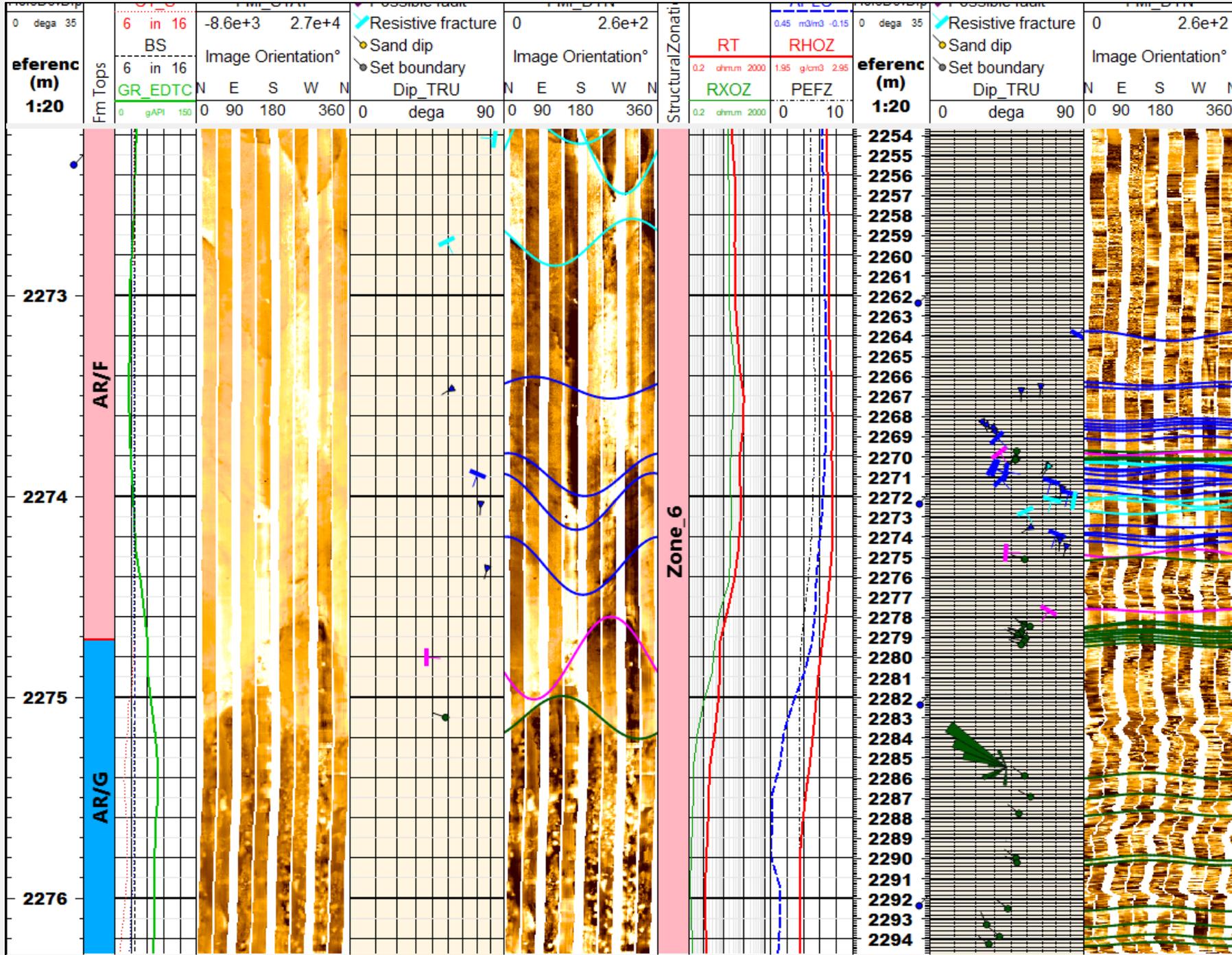


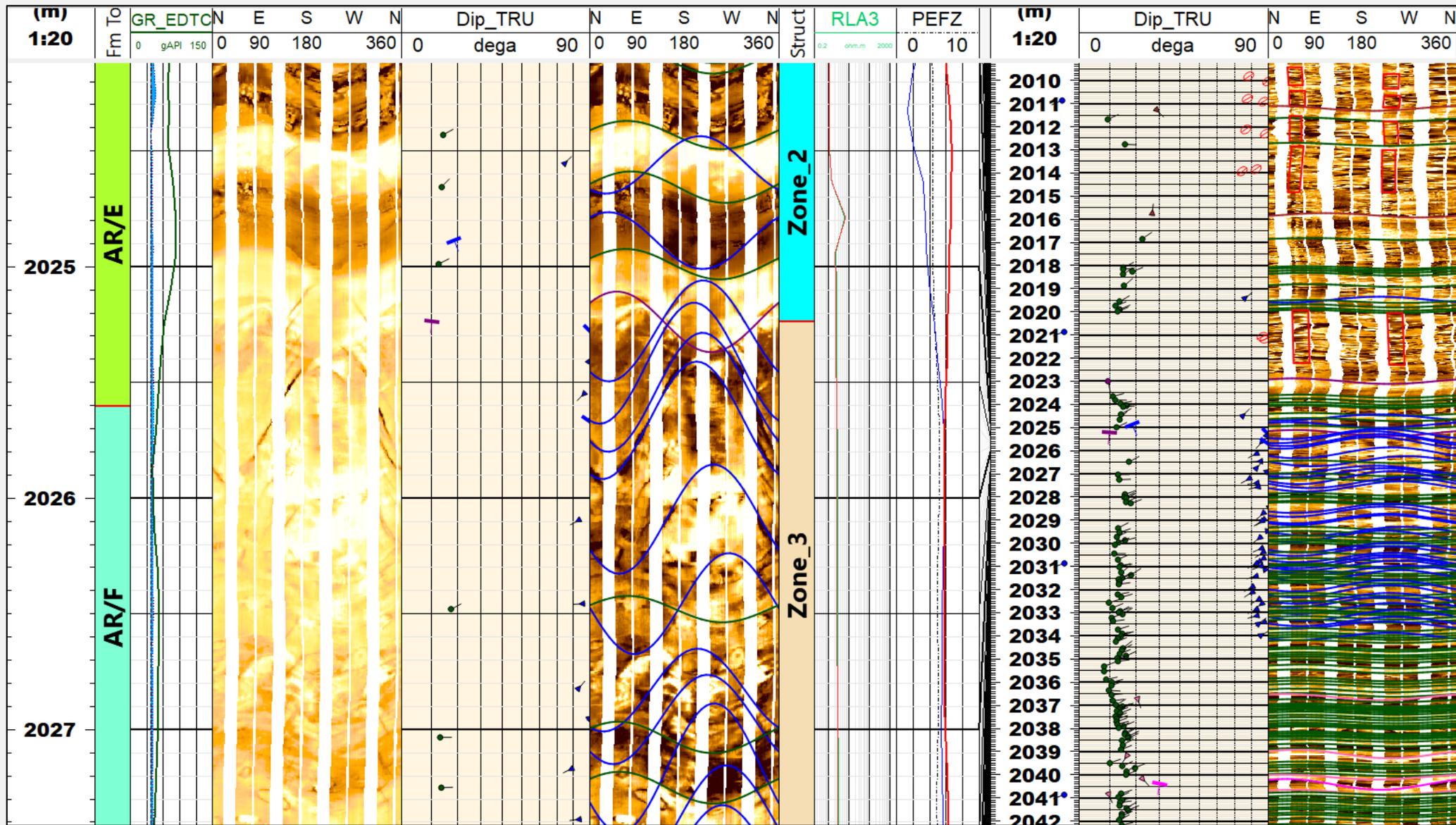


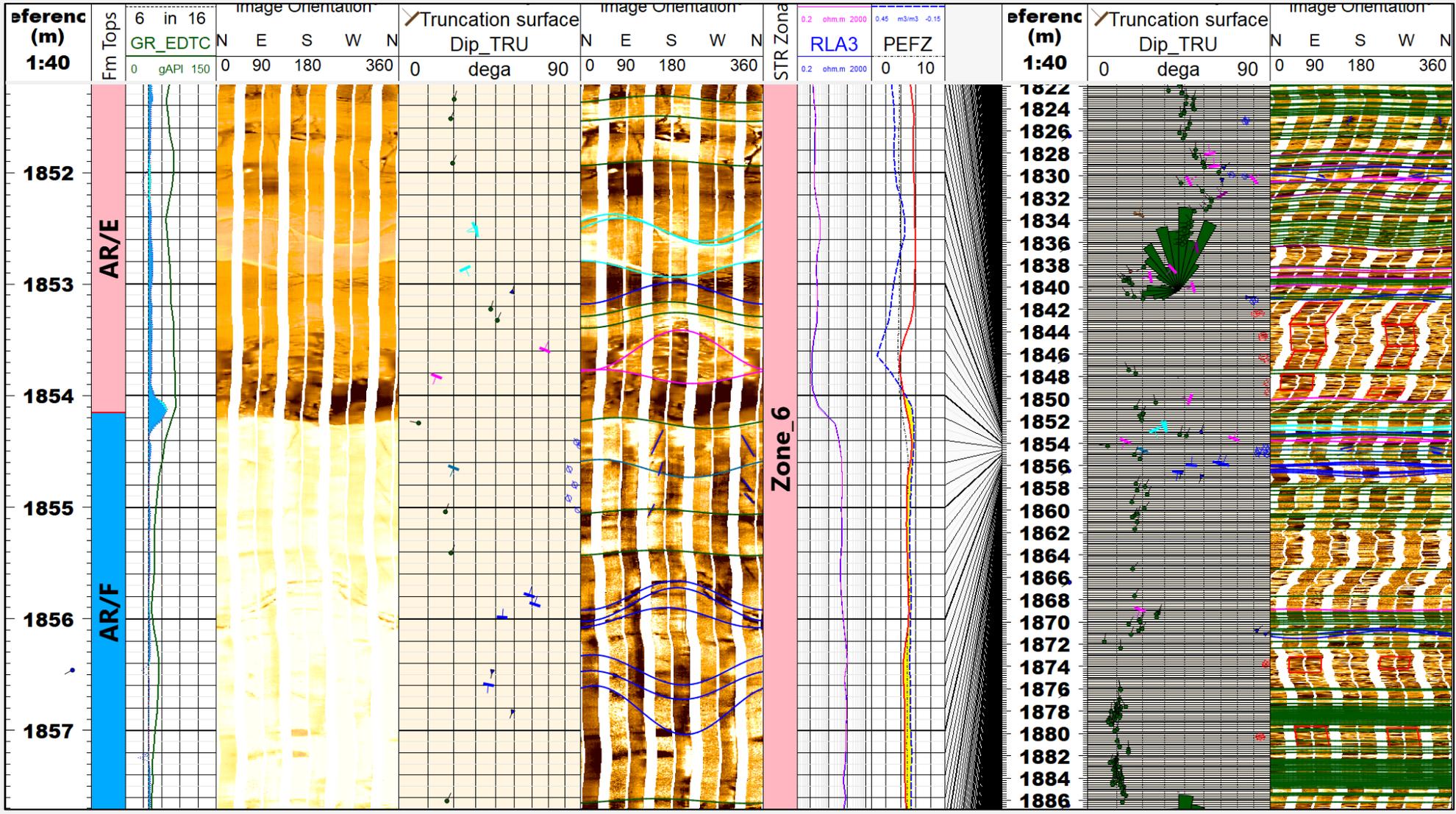
5000m

1:91212









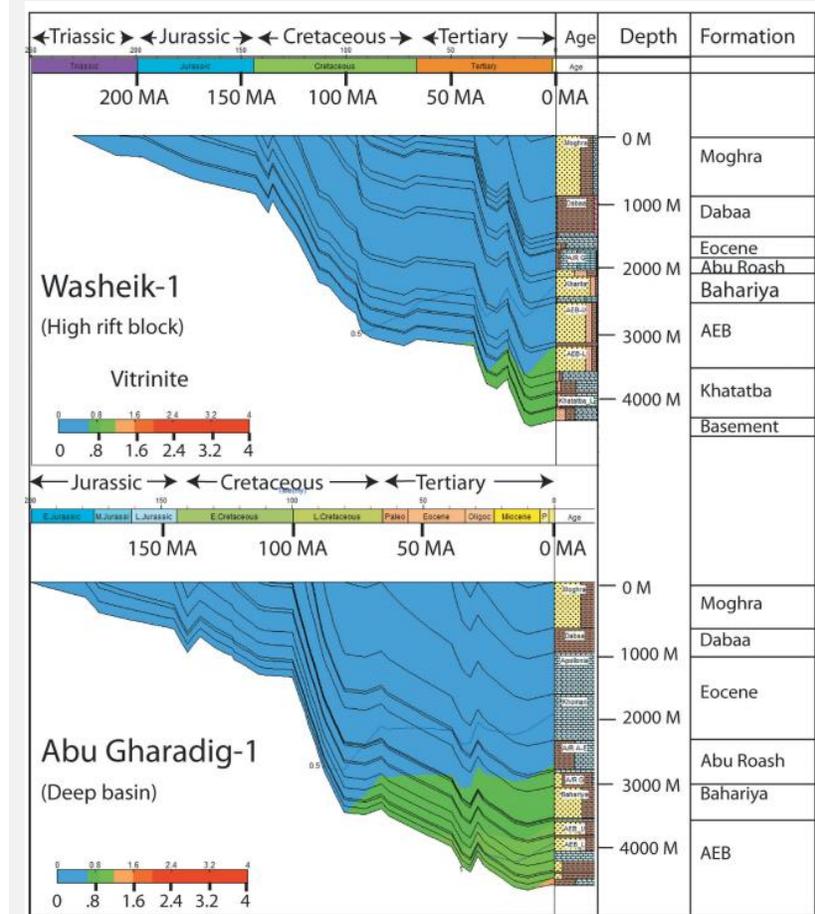
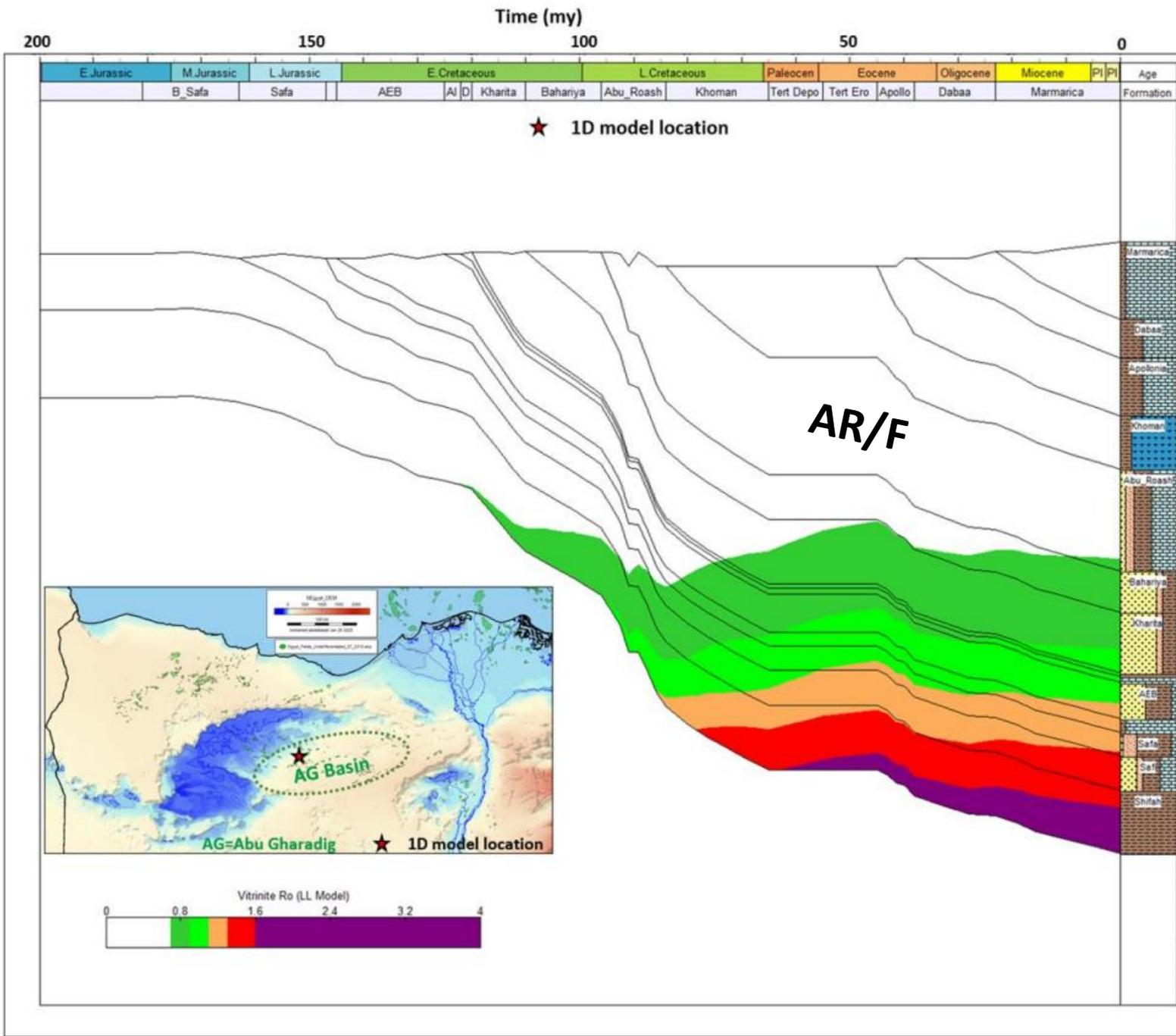
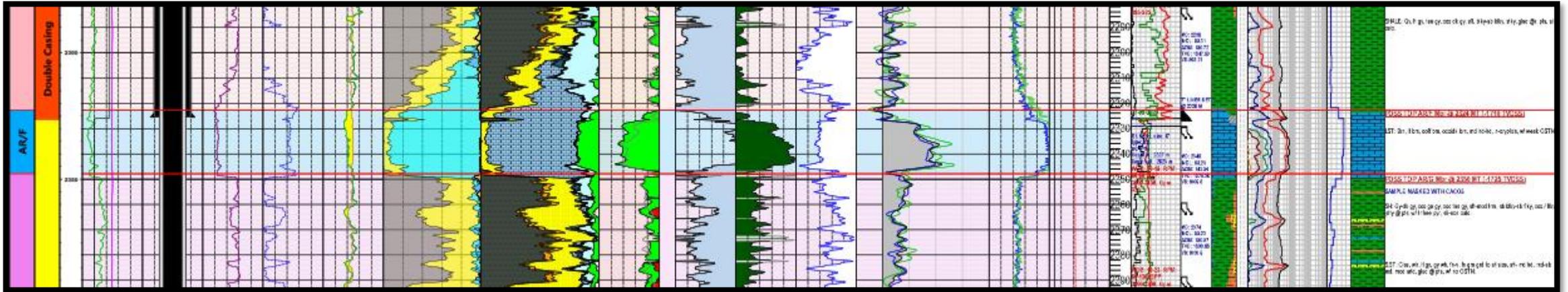
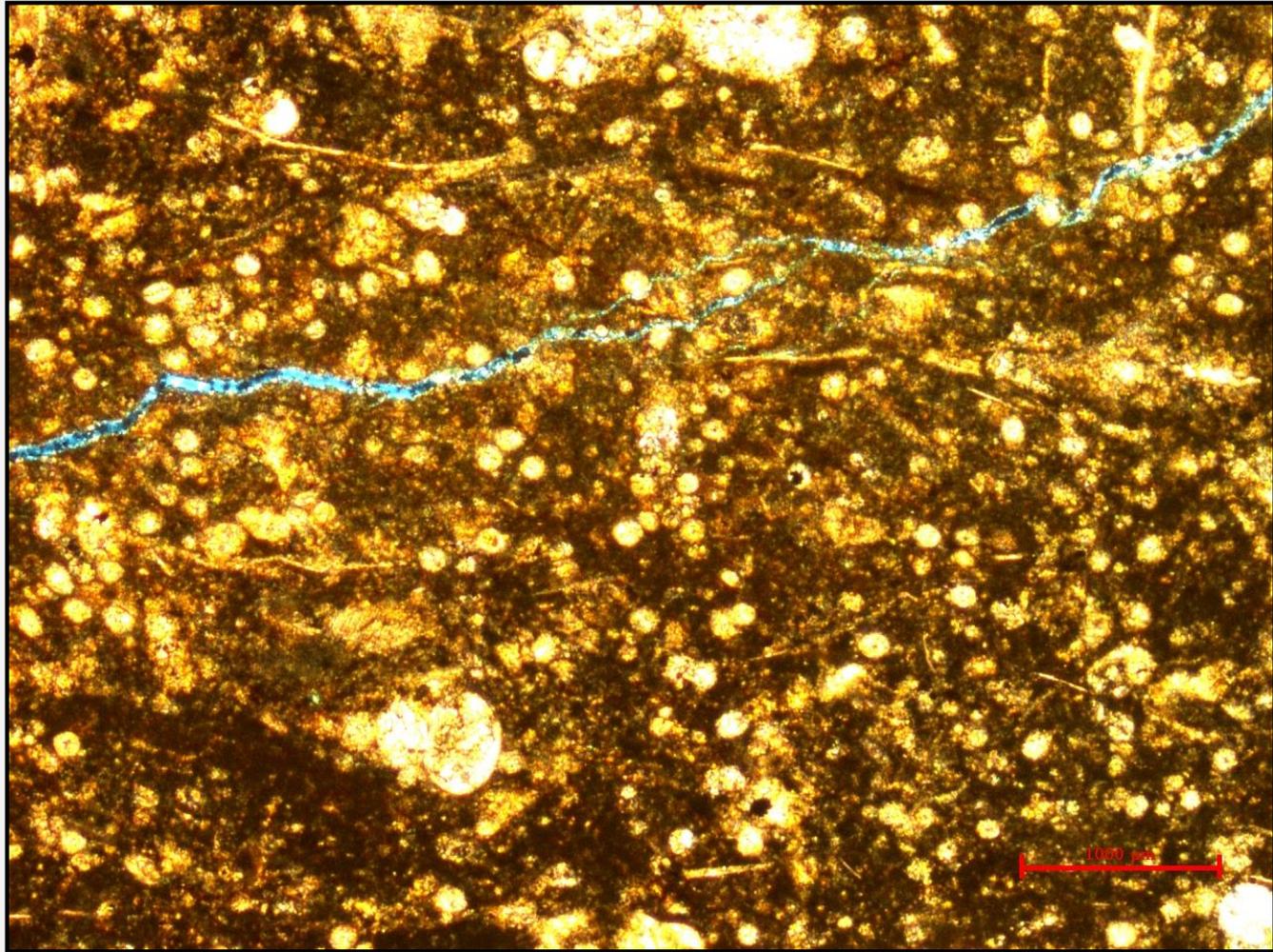
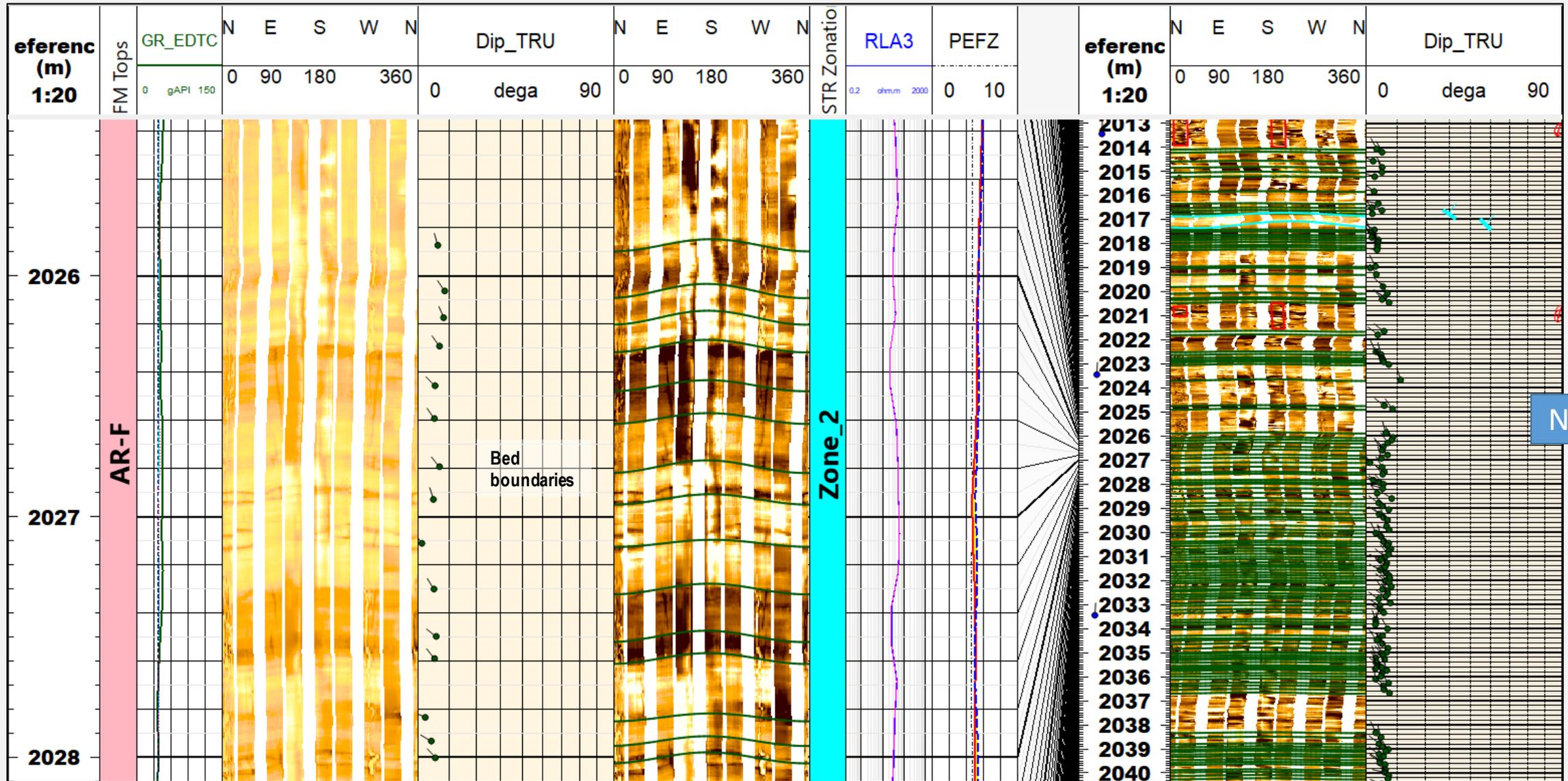


Figure 8. Comparison of basin modeling results from the Washeik-1 and Abu El Gharadig-1 wells showing variations in timing of hydrocarbon maturation and expulsion (see Figure 5 for location). 1000 m (3280.8 ft).



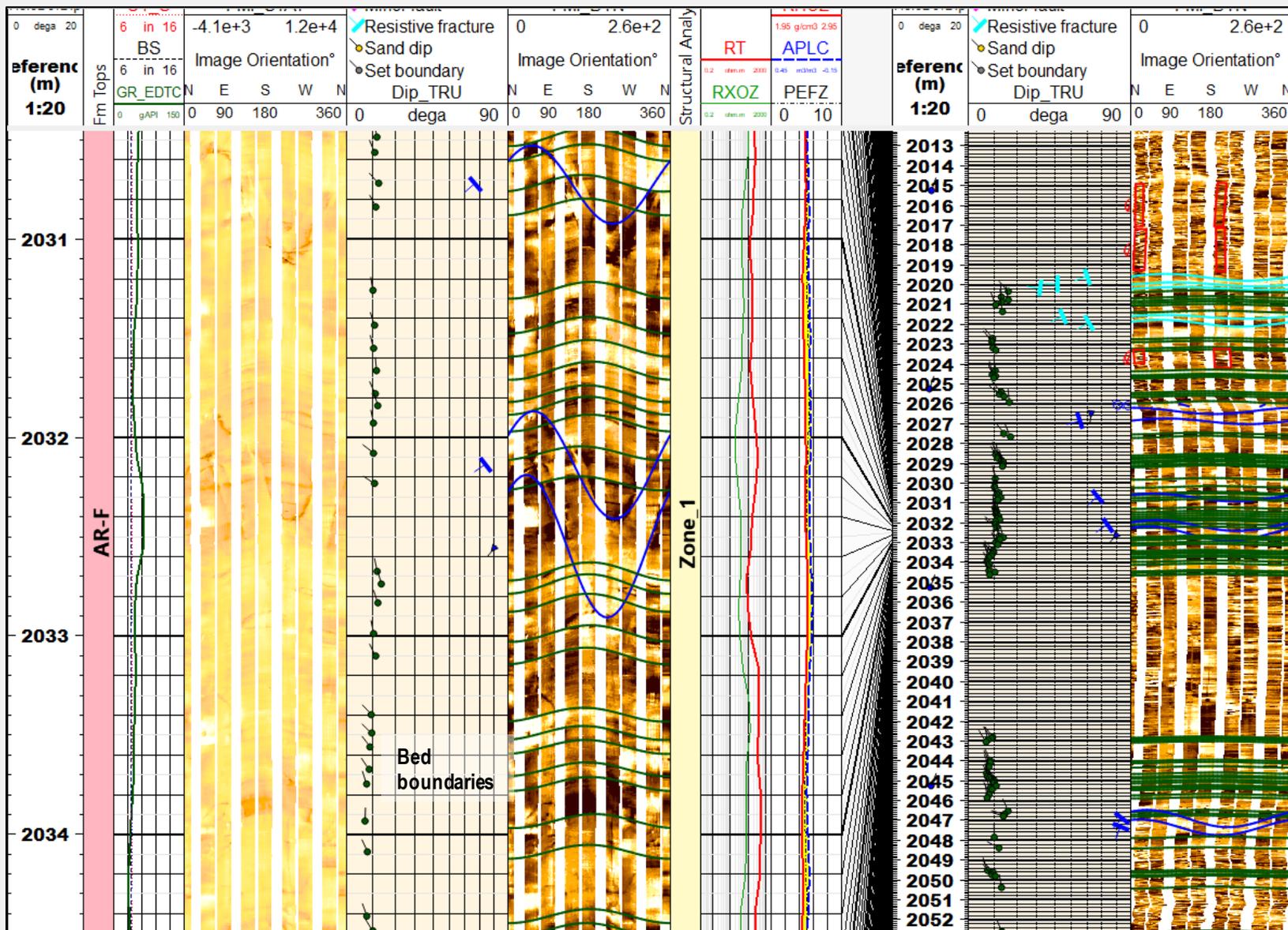
- AR/F appears to have a very large TOC content, which is interpreted to be most likely Kerogen. However, there is a possibility of it including some hydrocarbon due to the observed FNXS being slightly lower than the expected FNXS for Kerogen.





Snapshot example (Scale 20) within AR/F Member shows low dip bed boundary dips with NNW azimuth of bedded carbonate (green sinusoids).

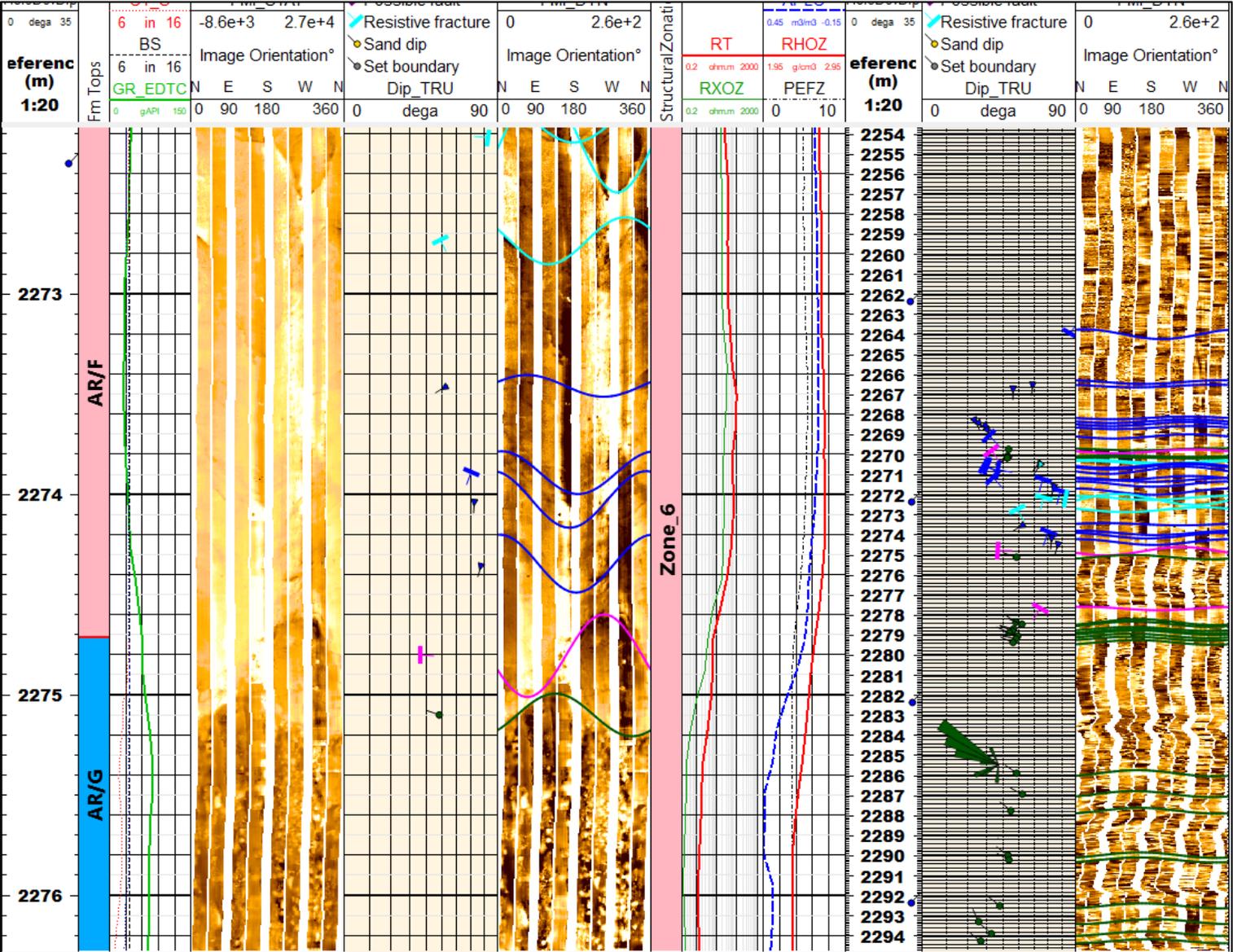
NEST-8



Snapshot example (Scale 20) within AR-F Member shows bed boundary dips (green sinusoids) with NNW azimuth of bedded carbonate. Note two conductive fractures at depths 2030.7m and 2032.2m and one discontinues conductive fracture at depth 2032.6m (blue sinusoids) with NW-SE strike and dipping SW.

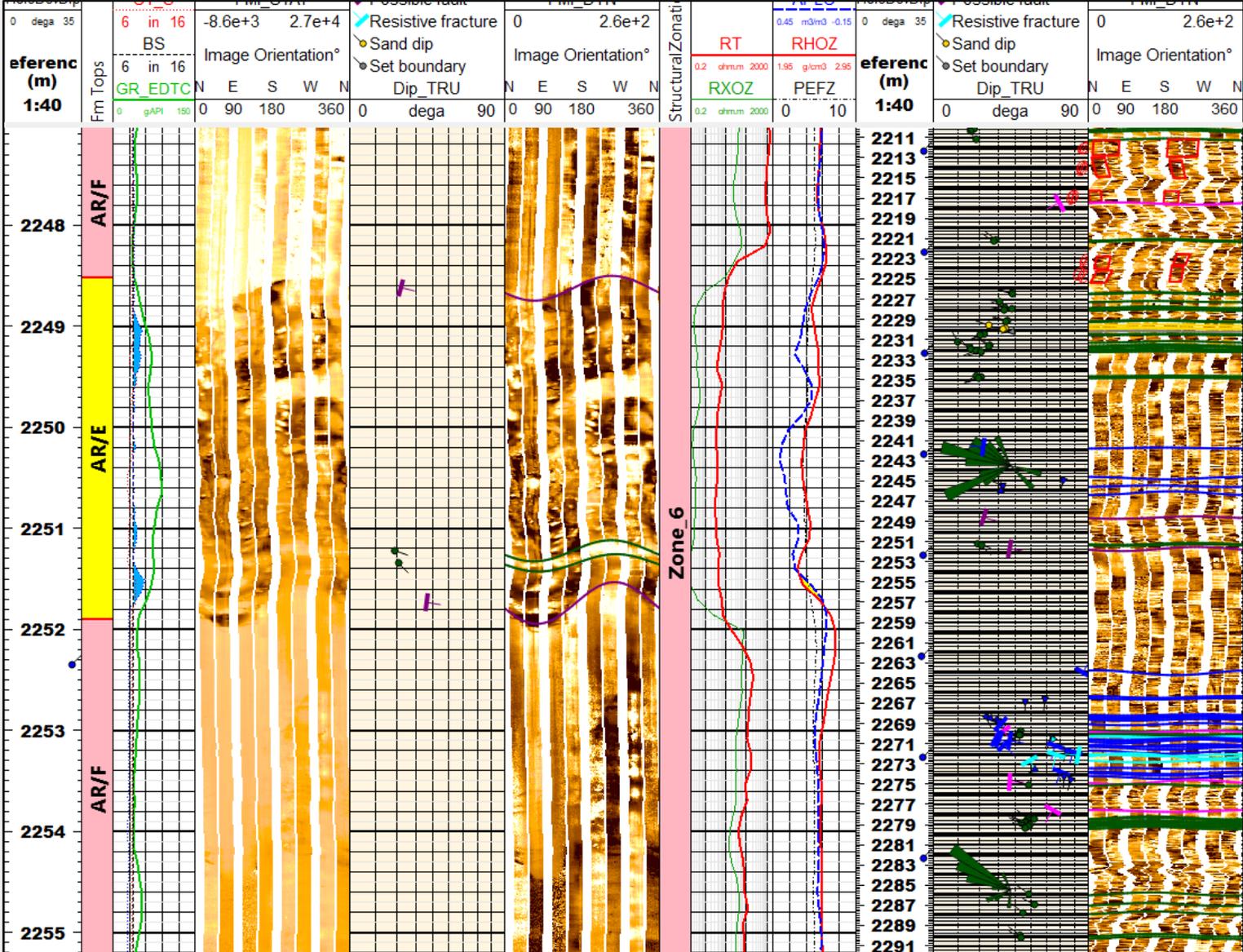
NEST-11

Snapshot example (Scale 20) showing a minor fault @2274.8m (pink tadpole) at AR/G and AR/F members boundary, striking NNE-SSW and dipping ~37 degree towards easterly-ESE. Note AR/G Member conductive darker appearance of argillaceous facies and AR/F Member light, resistive appearance of carbonate facies. Note discontinuous conductive and conductive fractures (blue tadpoles) and resistive fractures (cyan tadpoles) within AR/F Member.



NEST-11

Snapshot example (Scale 40) showing two possible faults @2248.6m and @2251.7m (Bounding repeated AR/E Member), striking NNE-SSW and dipping ESE (22.5°/105.0°, 36.8°/98.1°). Note truncation at possible fault cuts, brecciation and deformation between two possible fault cuts and also presence of minor faults associated with resistive and conductive fractures close to possible faults interval.

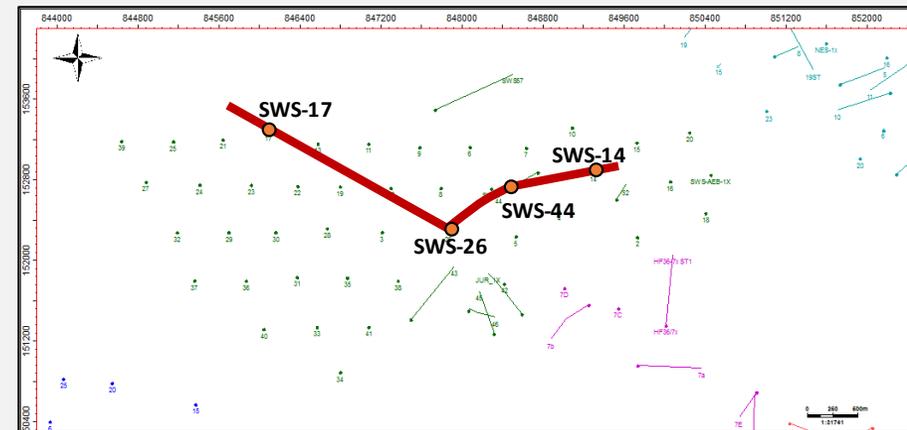
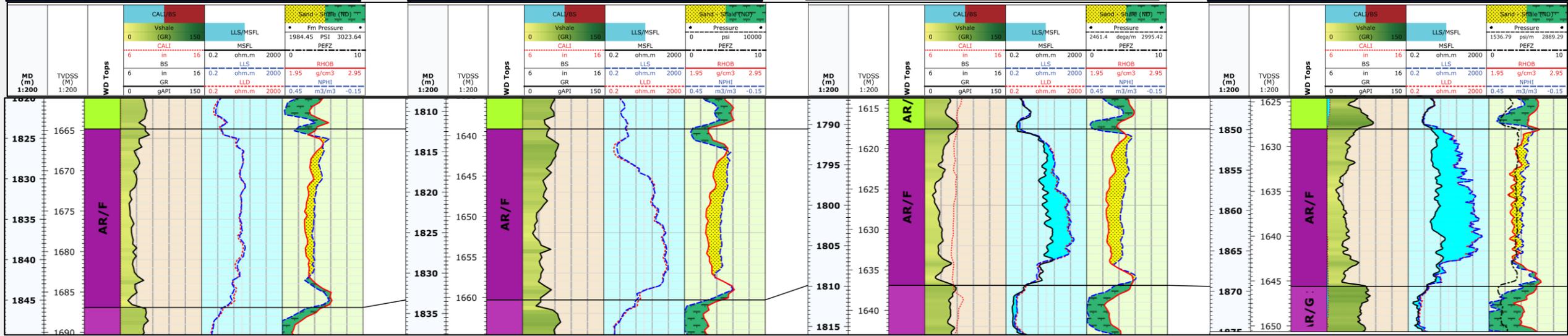


SWS-17

SWS-26

SWS-44

SWS-14



HF35/3

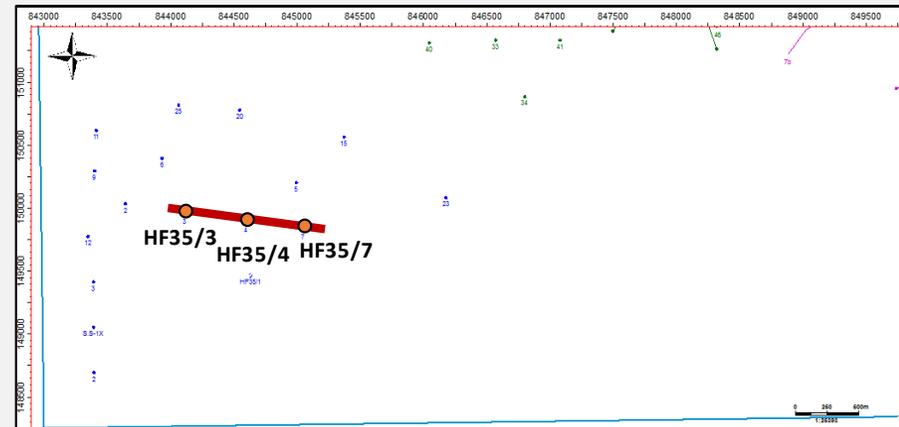
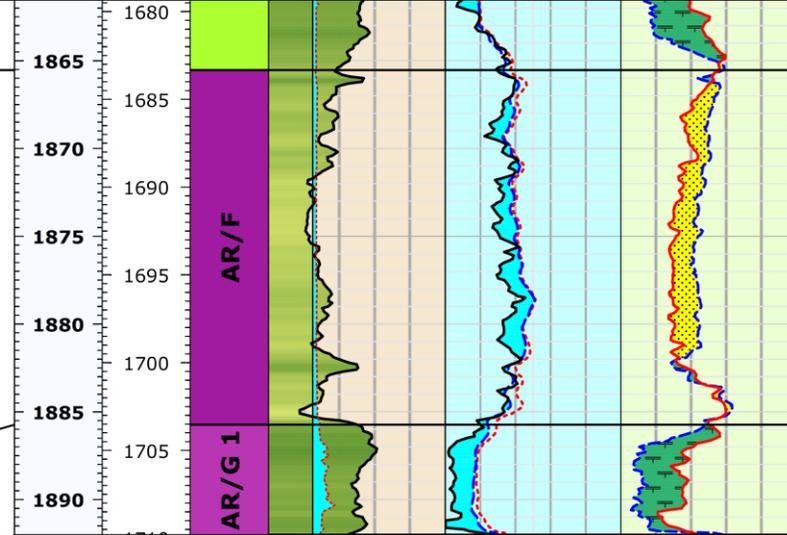
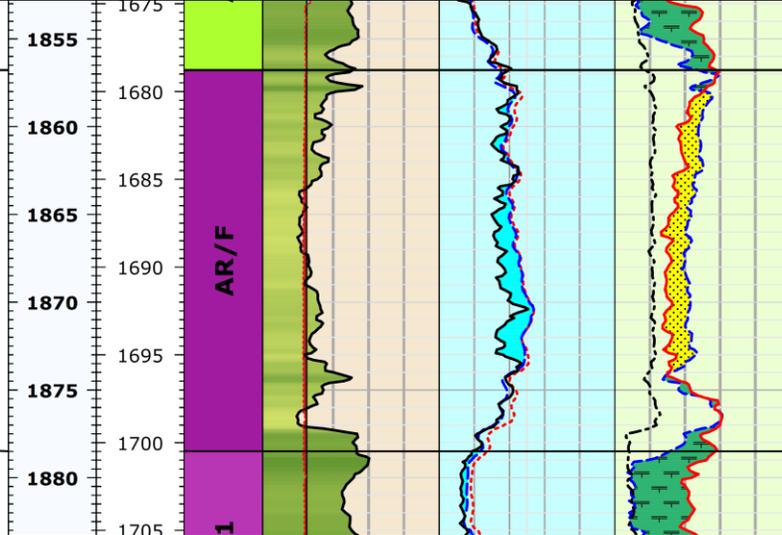
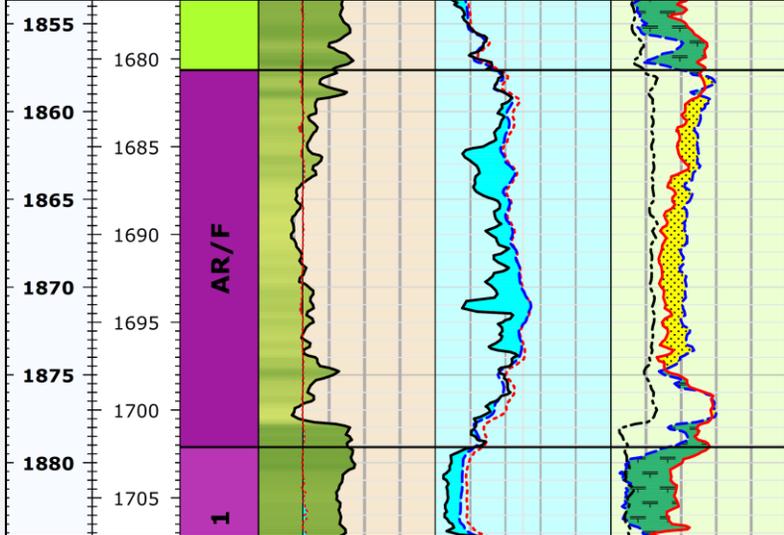
HF35/4

HF35/7

MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS		LLS/MSFL		Sand - Shale (ND)			
			Vshale (GR) 150				Fm Pressure			
			0				1984.45	PSI	3023.64	
			CALI		MSFL		PEFZ			
			6	in	16	0.2	ohm.m	2000	0	10
		BS		LLS		RHOB				
6	in	16	0.2	ohm.m	2000	1.95	g/cm3	2.95		
		GR		LLD		NPHI				
0	gAPI	150	0.2	ohm.m	2000	0.45	m3/m3	-0.15		

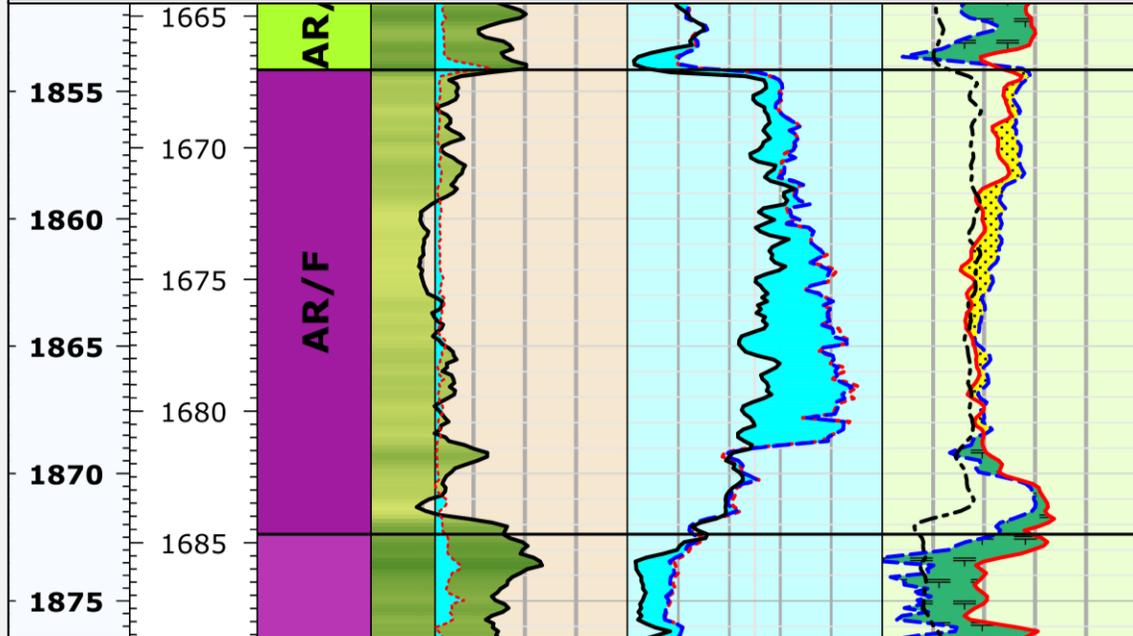
MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS		LLS/MSFL		Sand - Shale (ND)			
			Vshale (GR) 150				Pressure			
			0				0	psi	10000	
			CALI		MSFL		PEFZ			
			6	in	16	0.2	ohm.m	2000	0	10
		BS		LLS		RHOB				
6	in	16	0.2	ohm.m	2000	1.95	g/cm3	2.95		
		GR		LLD		NPHI				
0	gAPI	150	0.2	ohm.m	2000	0.45	m3/m3	-0.15		

MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS		LLS/MSFL		Sand - Shale (ND)			
			Vshale (GR) 150				Pressure			
			0				2461.4	dega/m	2995.42	
			CALI		MSFL		PEFZ			
			6	in	16	0.2	ohm.m	2000	0	10
		BS		LLS		RHOB				
6	in	16	0.2	ohm.m	2000	1.95	g/cm3	2.95		
		GR		LLD		NPHI				
0	gAPI	150	0.2	ohm.m	2000	0.45	m3/m3	-0.15		



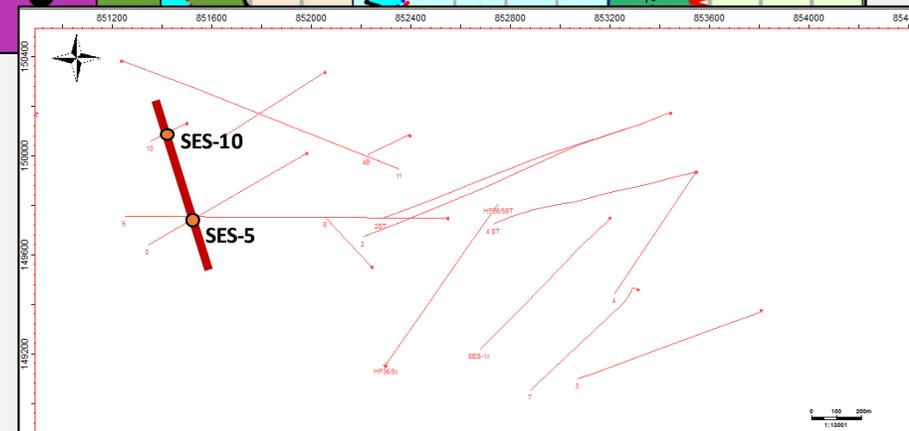
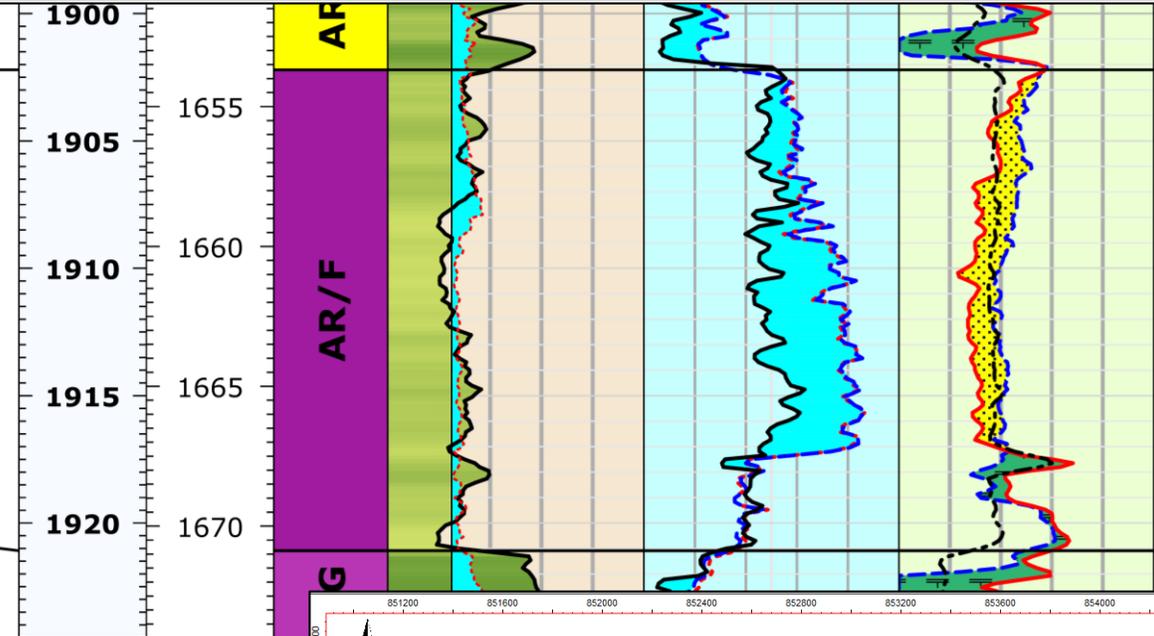
SES-10

MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS				Sand - Slate (ND)			
			Vshale (GR) 150	LLS/MSFL			Fm Pressure			
			0				1984.45	PSI	3023.64	
			CALI	MSFL			PEFZ			
			6 in 16	0.2	ohm.m	2000	0	10		
			BS	LLS			RHOB			
6 in 16	0.2	ohm.m	2000	1.95	g/cm3	2.95				
GR	LLD			NPHI						
0 gAPI 150	0.2	ohm.m	2000	0.45	m3/m3	-0.15				



SES-5

MD (m) 1:200	TVDSS (M) 1:200	ARWD Tops	CALI/BS				Sand - Slate (ND)			
			Vshale (GR) 150	LLS/MSFL			Pressure			
			0				0	psi	10000	
			CALI	MSFL			PEFZ			
			6 in 16	0.2	ohm.m	2000	0	10		
			BS	LLS			RHOB			
6 in 16	0.2	ohm.m	2000	1.95	g/cm3	2.95				
GR	LLD			NPHI						
0 gAPI 150	0.2	ohm.m	2000	0.45	m3/m3	-0.15				



NEST-4

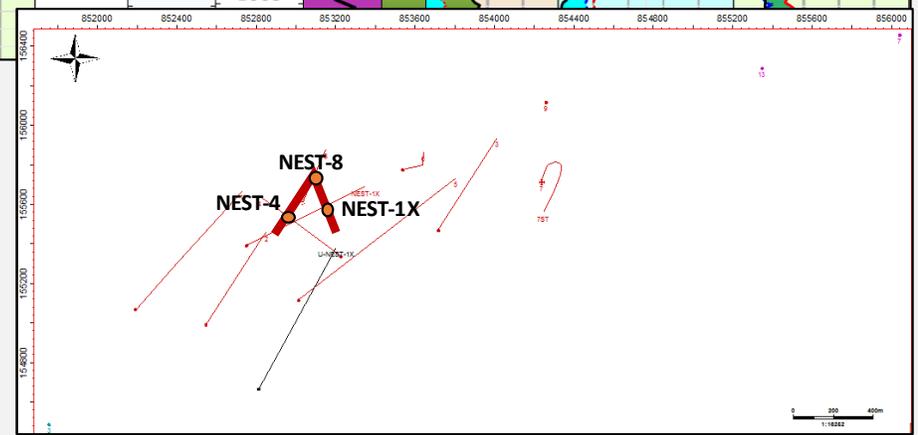
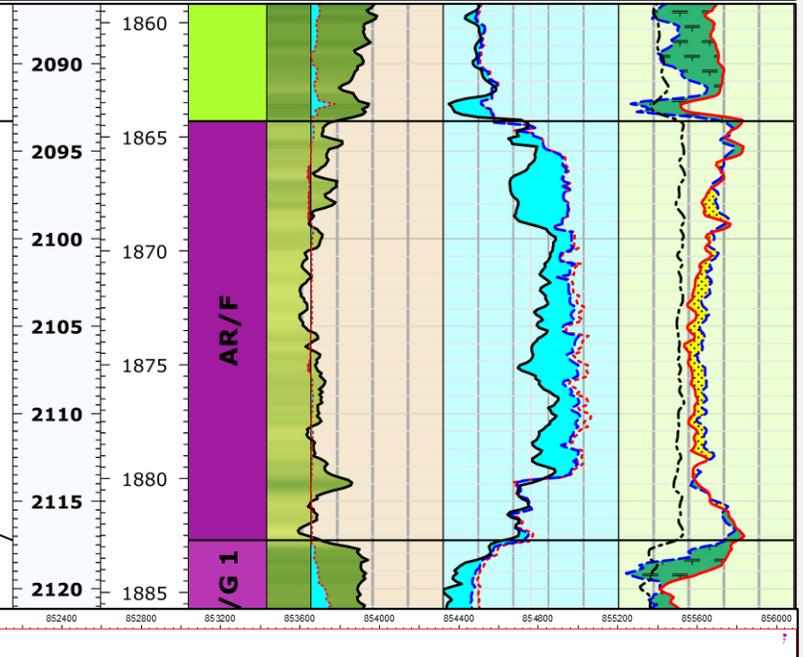
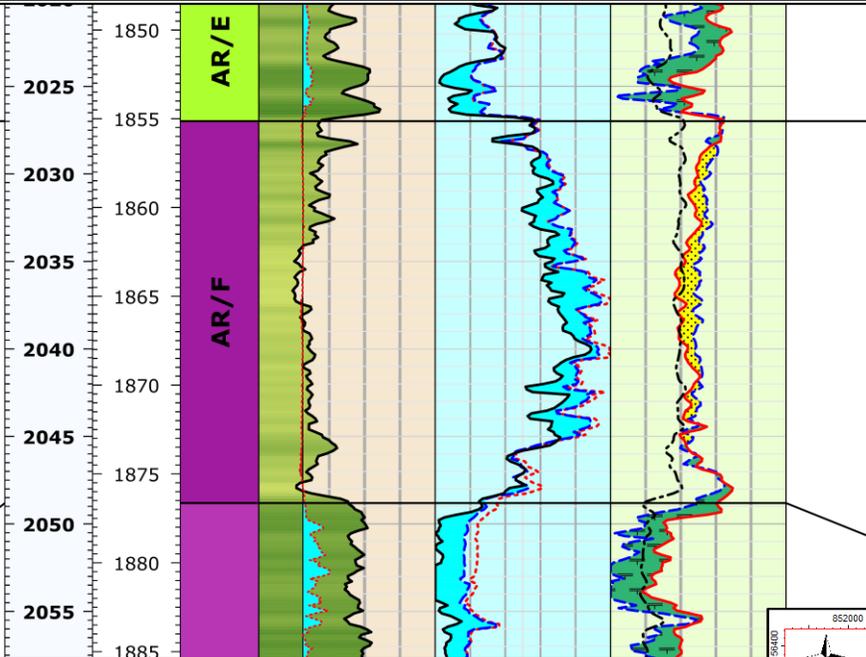
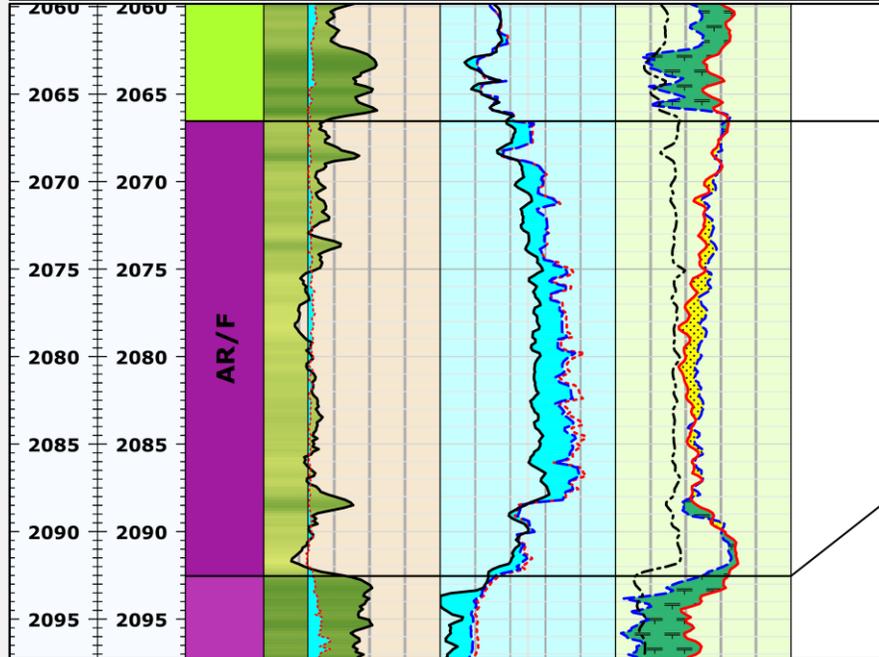
NEST-8

NEST-1X

MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS		LLS/MSFL		Sand - Shale (ND)		Fm Pressure		
			Vshale (GR)	150	0.2	ohm.m	2000	1984.45	PSI	3023.64	
			CALI	MSFL	PEFZ						
			6	in	16	0.2	ohm.m	2000	0	RHOB	10
			BS	LLS							
6	in	16	0.2	ohm.m	2000	1.95	g/cm3	2.95			
	GR	LLD									
0	gAPI	150	0.2	ohm.m	2000	0.45	m3/m3	-0.15			

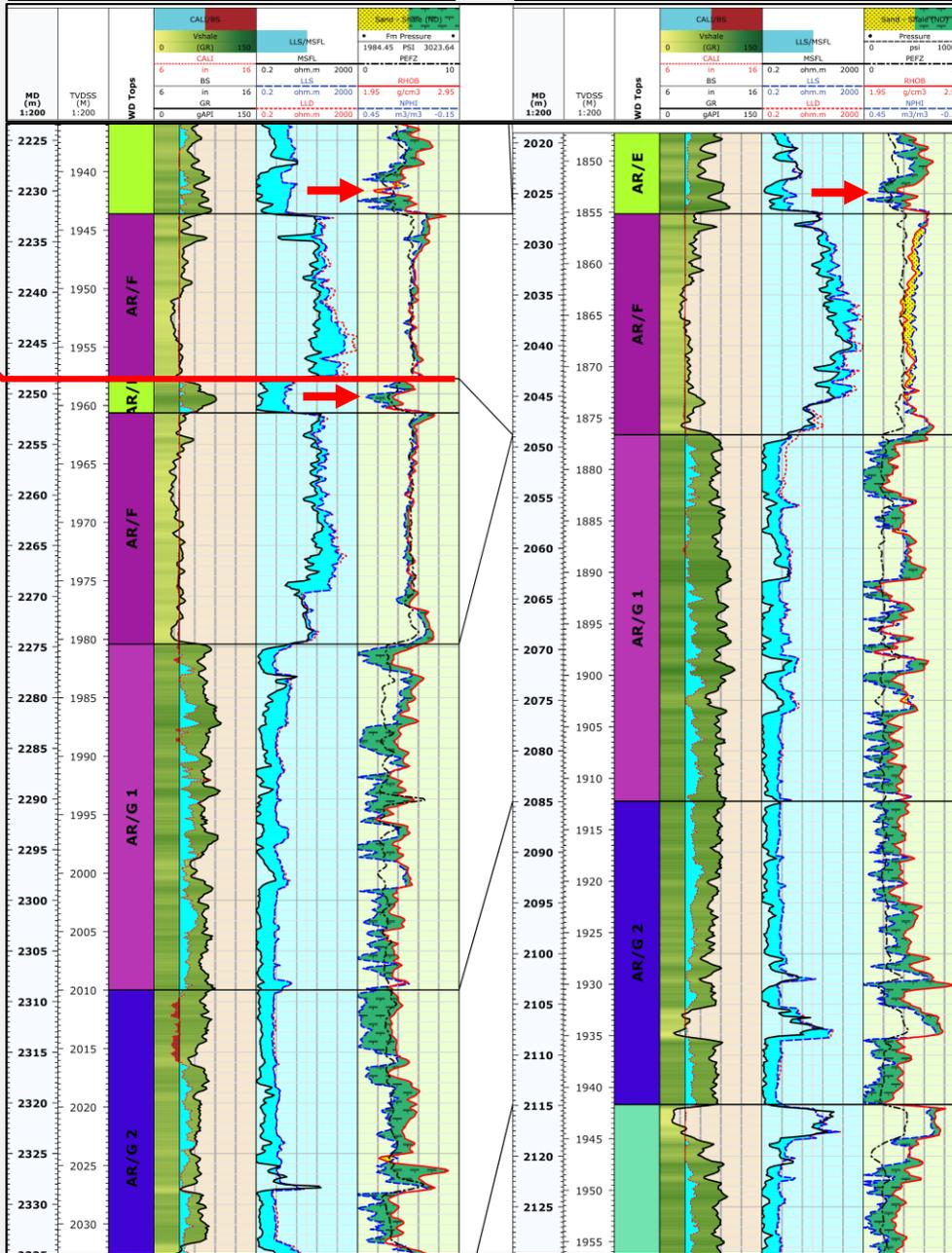
MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS		LLS/MSFL		Sand - Shale (ND)		Pressure		
			Vshale (GR)	150	0.2	ohm.m	2000	0	psi	10000	
			CALI	MSFL	PEFZ						
			6	in	16	0.2	ohm.m	2000	0	RHOB	10
			BS	LLS							
6	in	16	0.2	ohm.m	2000	1.95	g/cm3	2.95			
	GR	LLD									
0	gAPI	150	0.2	ohm.m	2000	0.45	m3/m3	-0.15			

MD (m) 1:200	TVDSS (M) 1:200	WD Tops	CALI/BS		LLS/MSFL		Sand - Shale (ND)		Pressure		
			Vshale (GR)	150	0.2	ohm.m	2000	0	psi	10000	
			CALI	MSFL	PEFZ						
			6	in	16	0.2	ohm.m	2000	0	RHOB	10
			BS	LLS							
6	in	16	0.2	ohm.m	2000	1.95	g/cm3	2.95			
	GR	LLD									
0	gAPI	150	0.2	ohm.m	2000	0.45	m3/m3	-0.15			

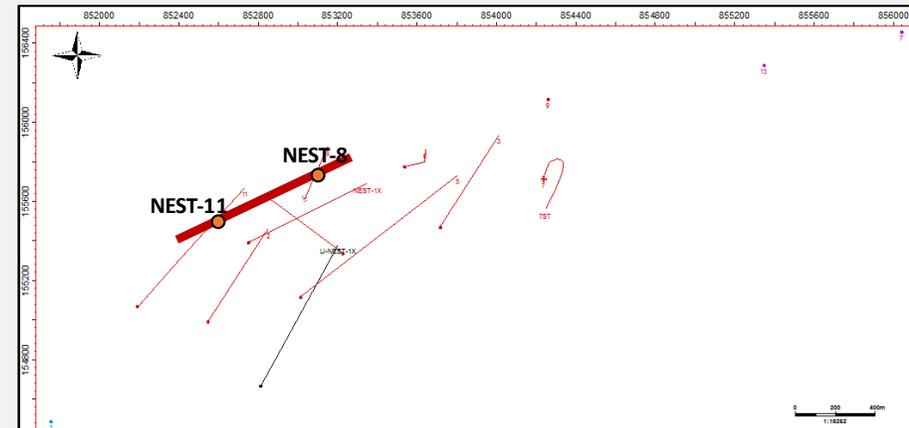


NEST-11

NEST-8



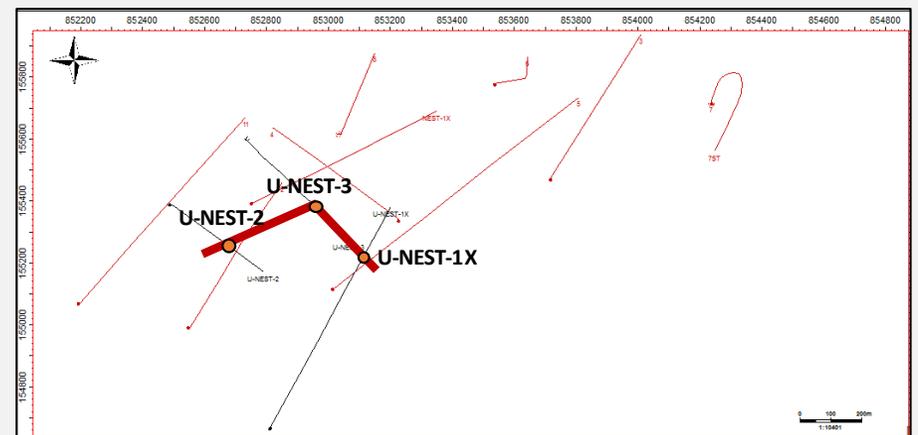
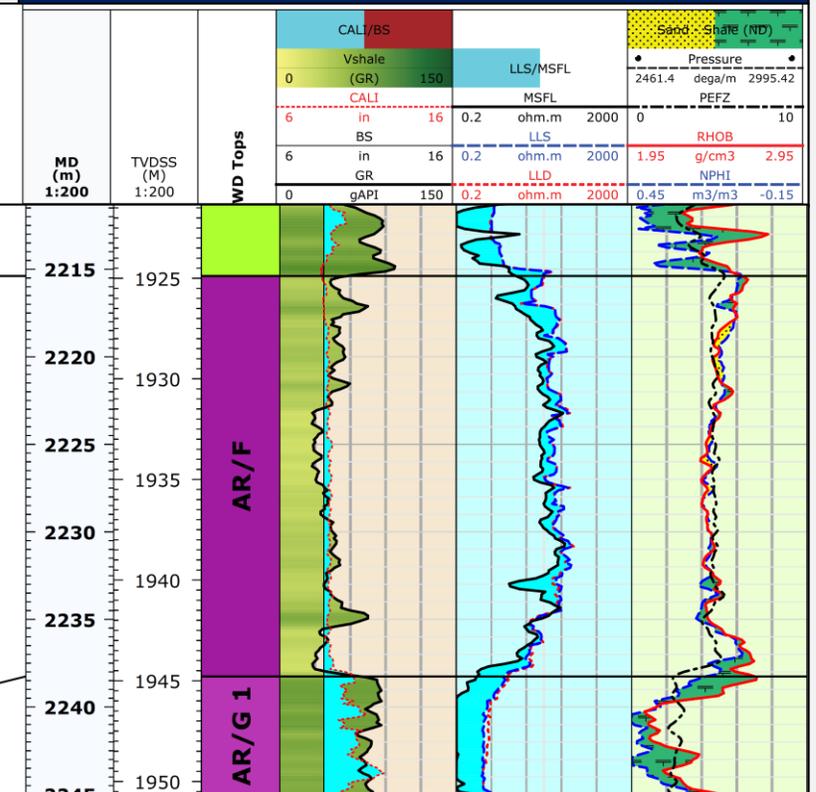
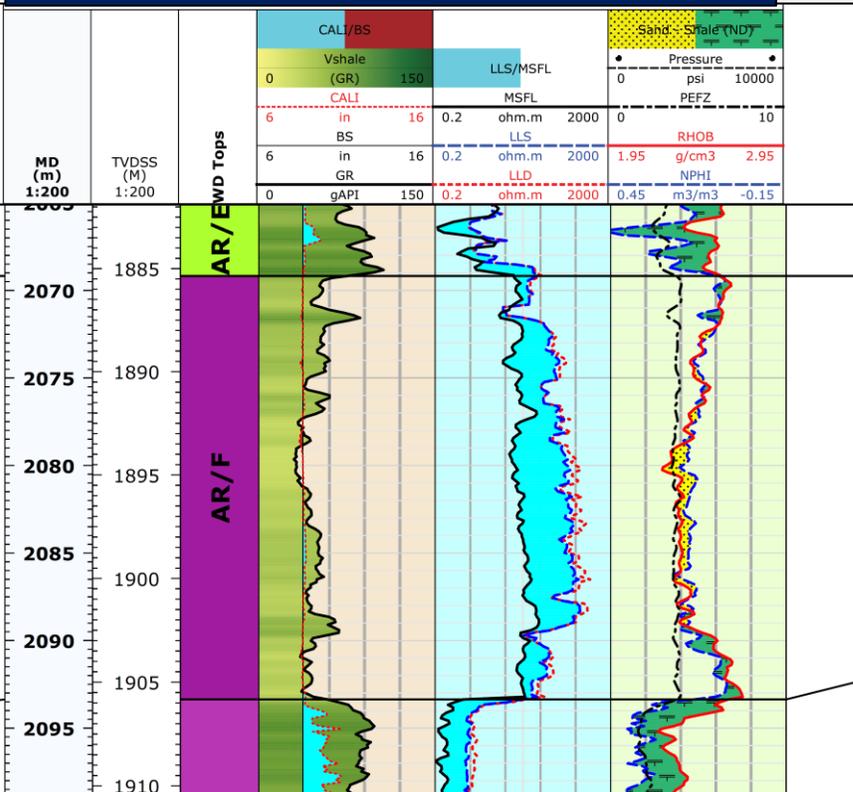
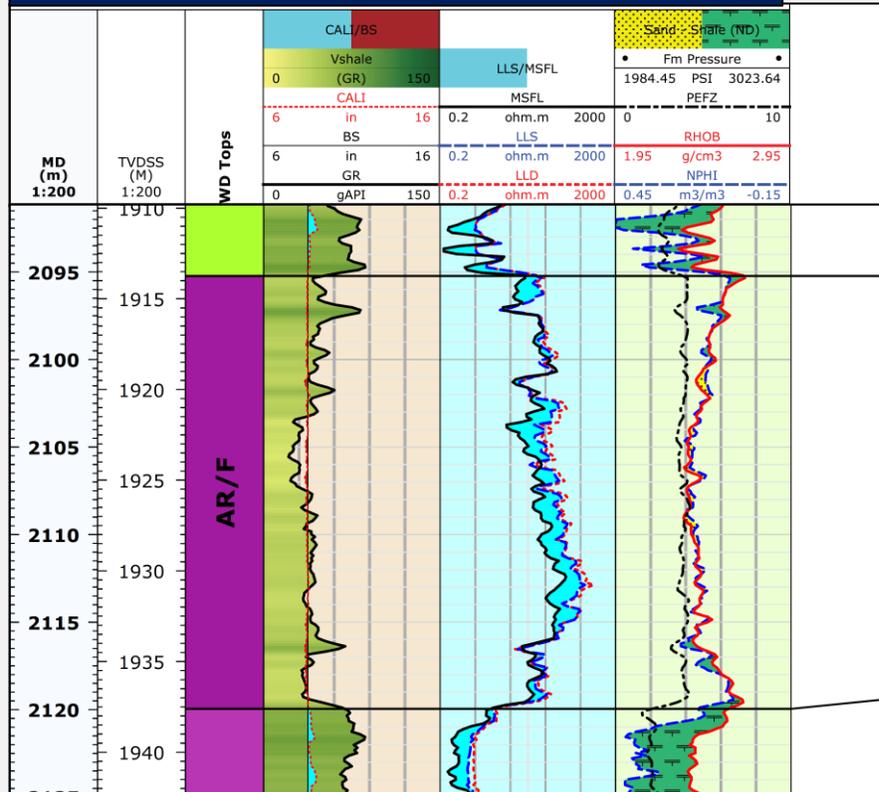
Reverse Fault



U-NEST-2

U-NEST-3

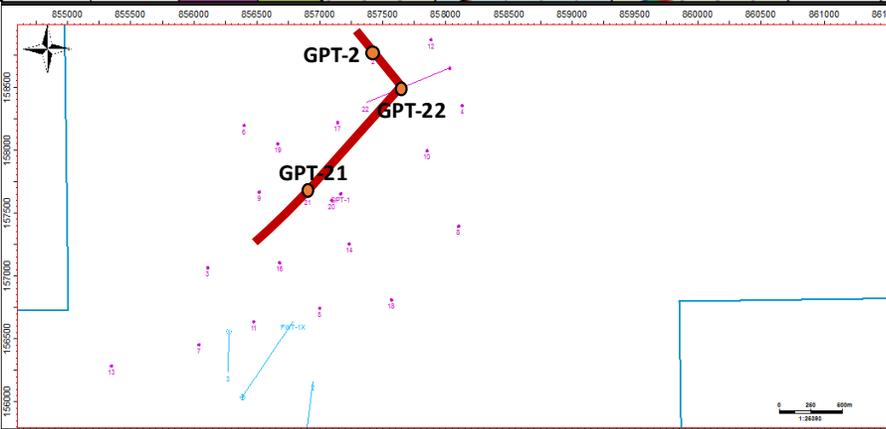
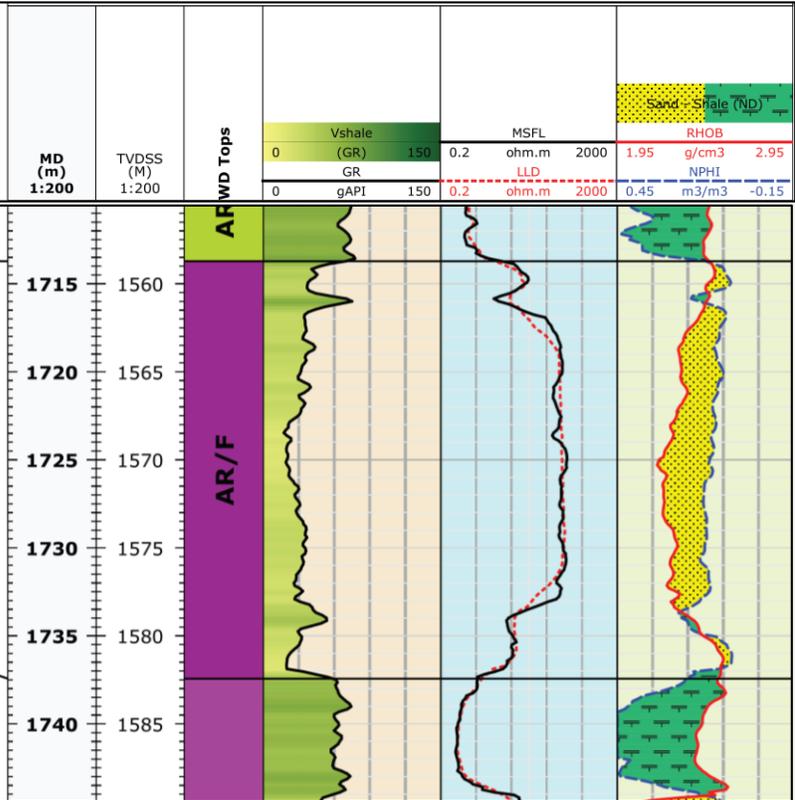
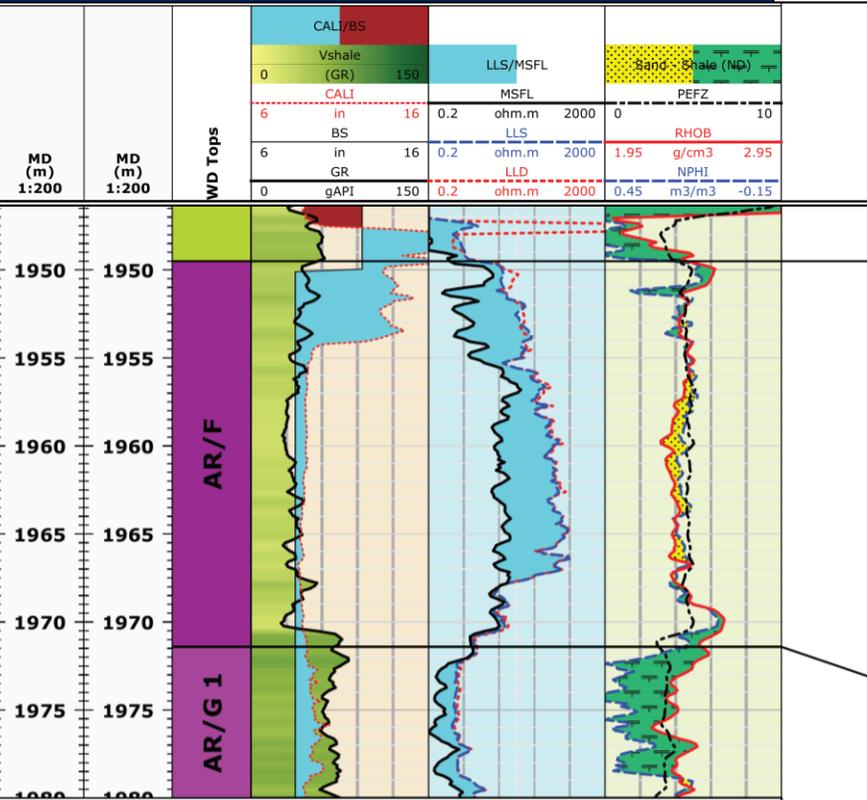
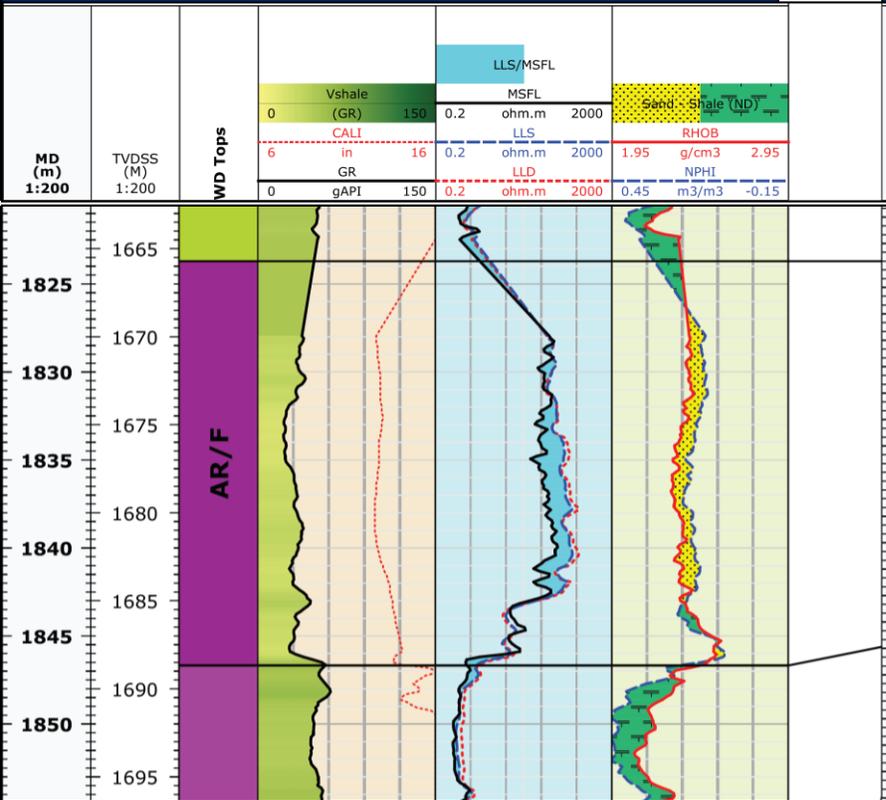
U-NEST-1X



GPT-2

GPT-22

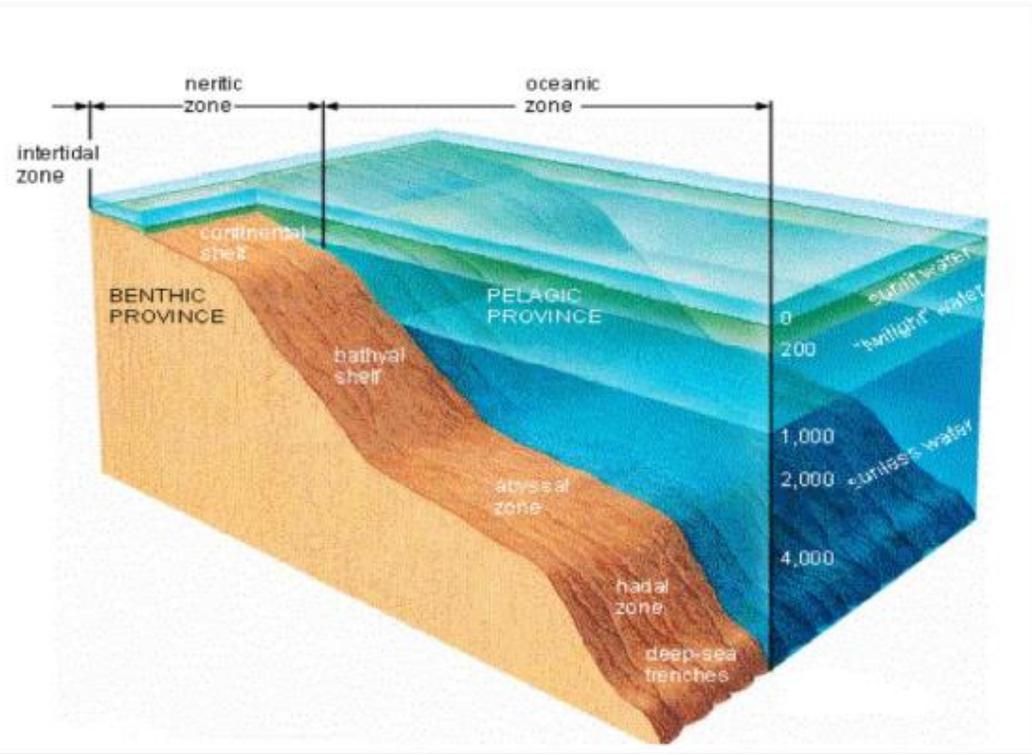
GPT-21



Cum.Oil: 541BBL
Cum.Gas: 29,467 MSCF

-DEPOSITINAL ENVIRONMENT INTERPERTATION

For ABU ROASH (F) MEMBER.



This succession is dominated by carbonate facies; bedded, laminated limestone intercalated with streaks of marly facies. This is interpreted as *outer-neritic* carbonate deposits. It is overlain by massive mudstone facies which is interpreted as shelf mudstone deposits.

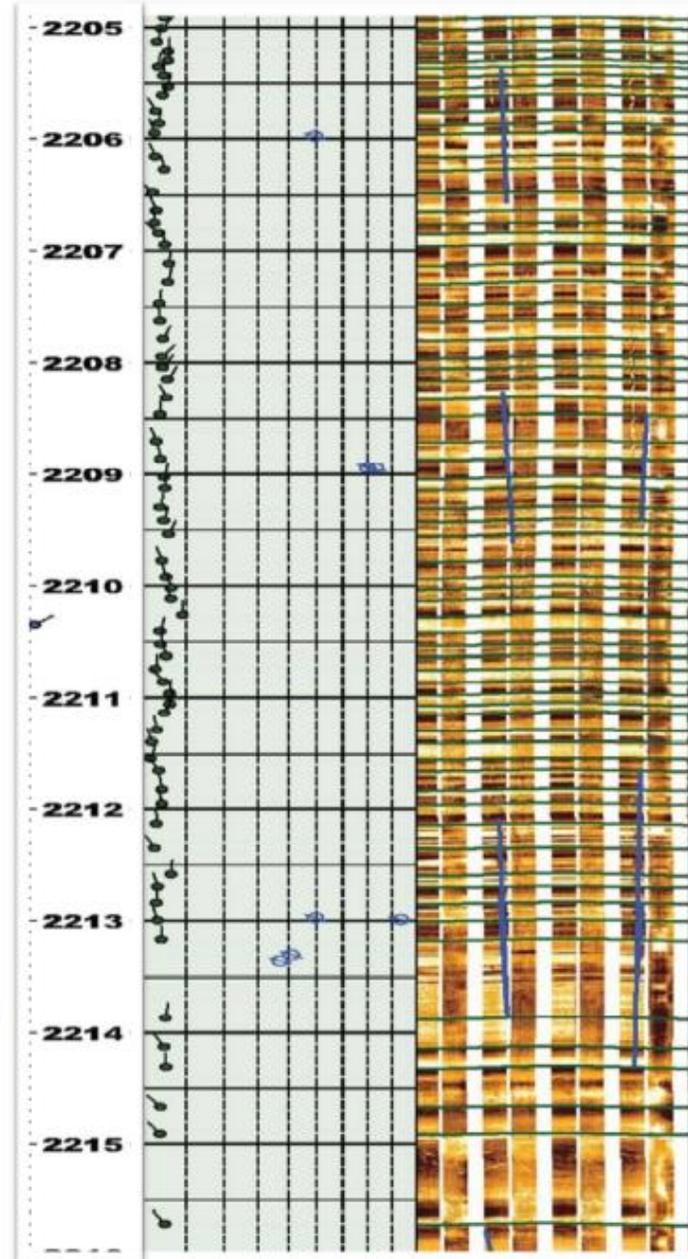
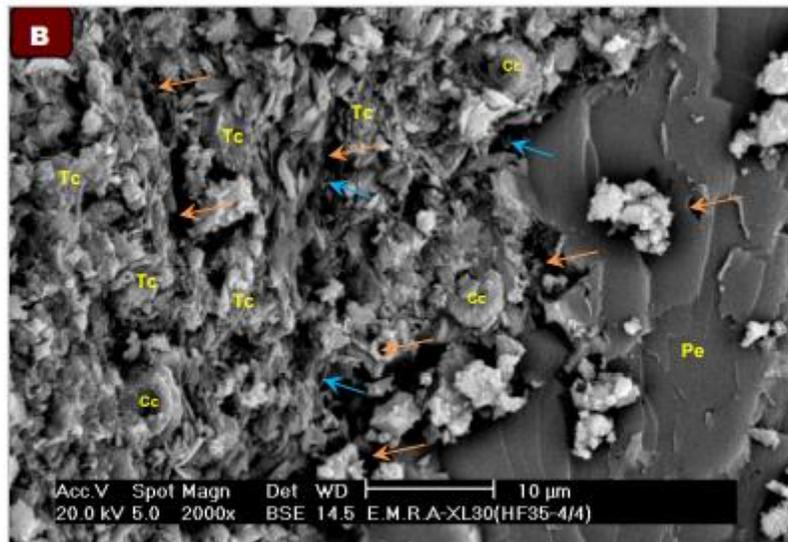
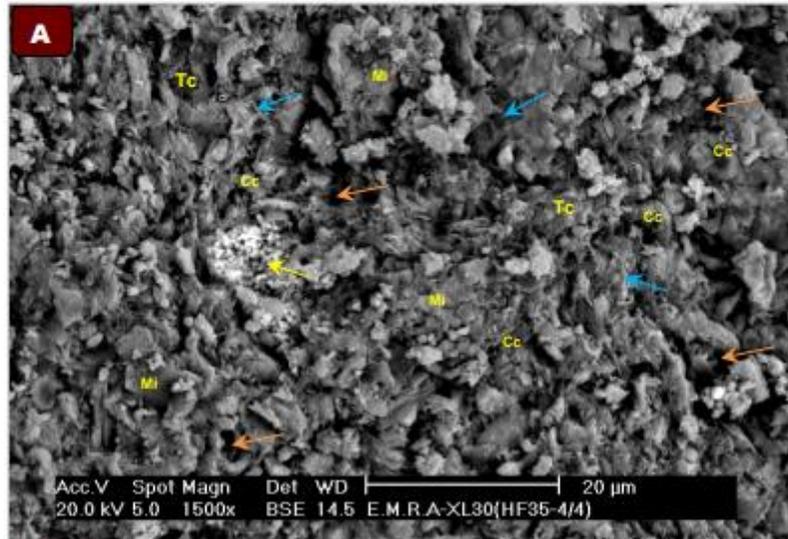
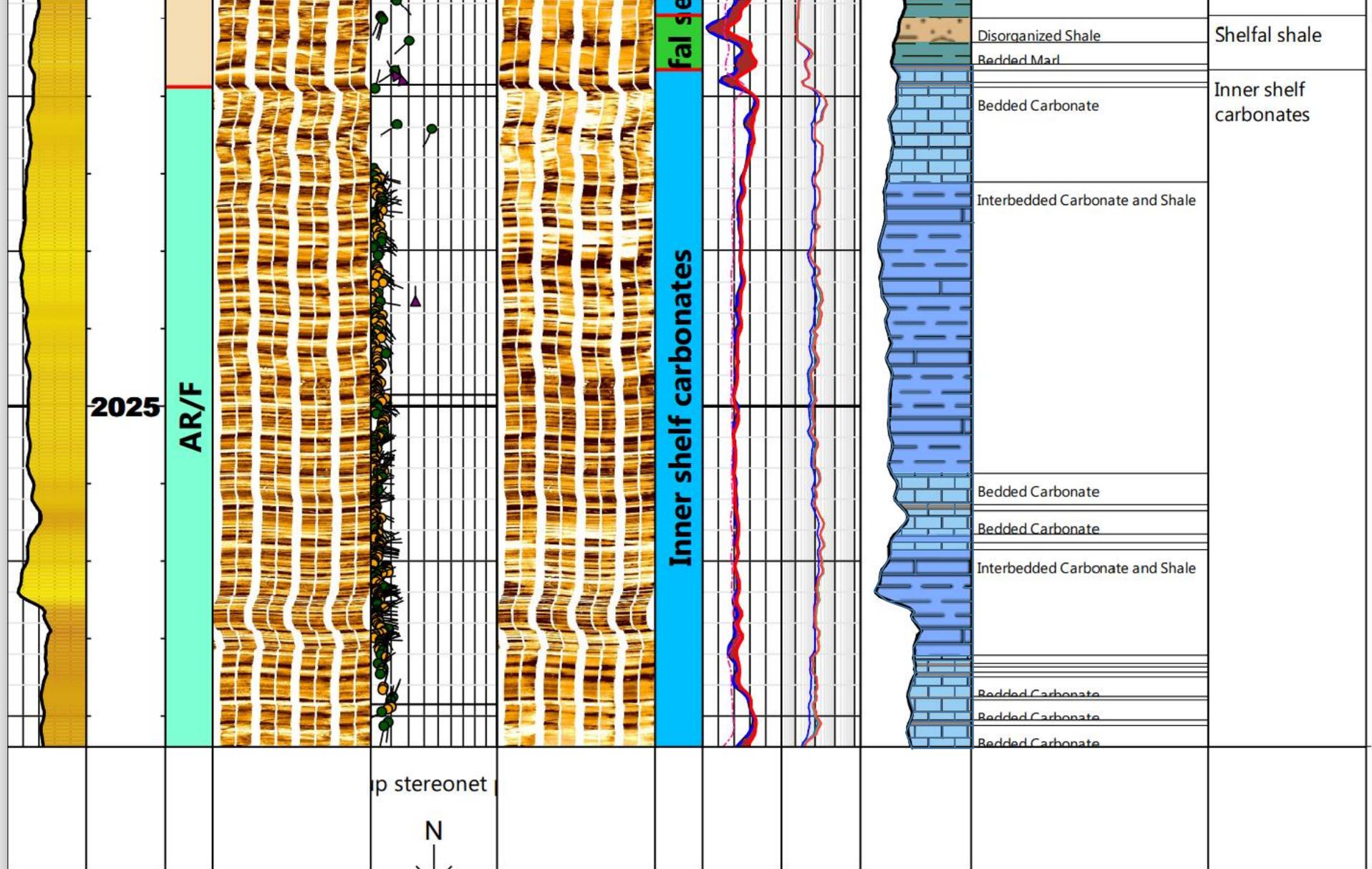


PLATE 4

COMPANY: GPC
Depth: 1875.95 m
Sample Type: Core

WELL: HF 35-4
Photo Type: SEM
Formation: AR/F





Egypt Basins: Abu Raosh structure and Abu Raosh and Bahariya Fields

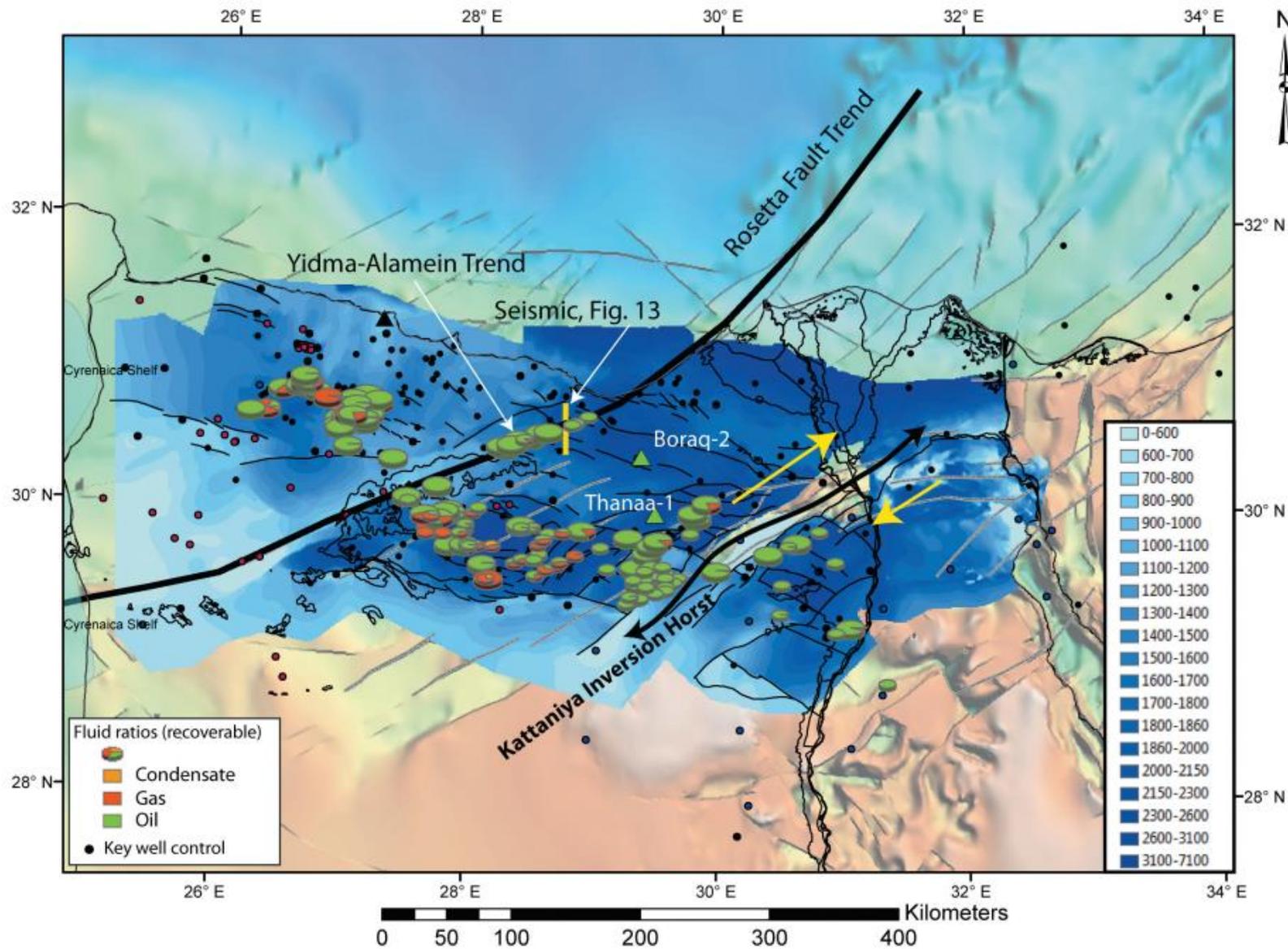


Figure 19. Depth structure map of the Cenomanian Abu Roash Formation. Production from Abu Roash and Bahariya fields are indicated by the small pie charts. Triangles denote the locations of the Boraq-2 and Thanaa-1 wells which have recently tested the Abu Roash interval. Arrows show dextral strike-slip motion along the Kattaniya Horst during Syrian Arc transpression. Background map is regional SEEBASE basement structure relief. 50 km (31 mi).