Alam El-Buieb Sustainable Success

And

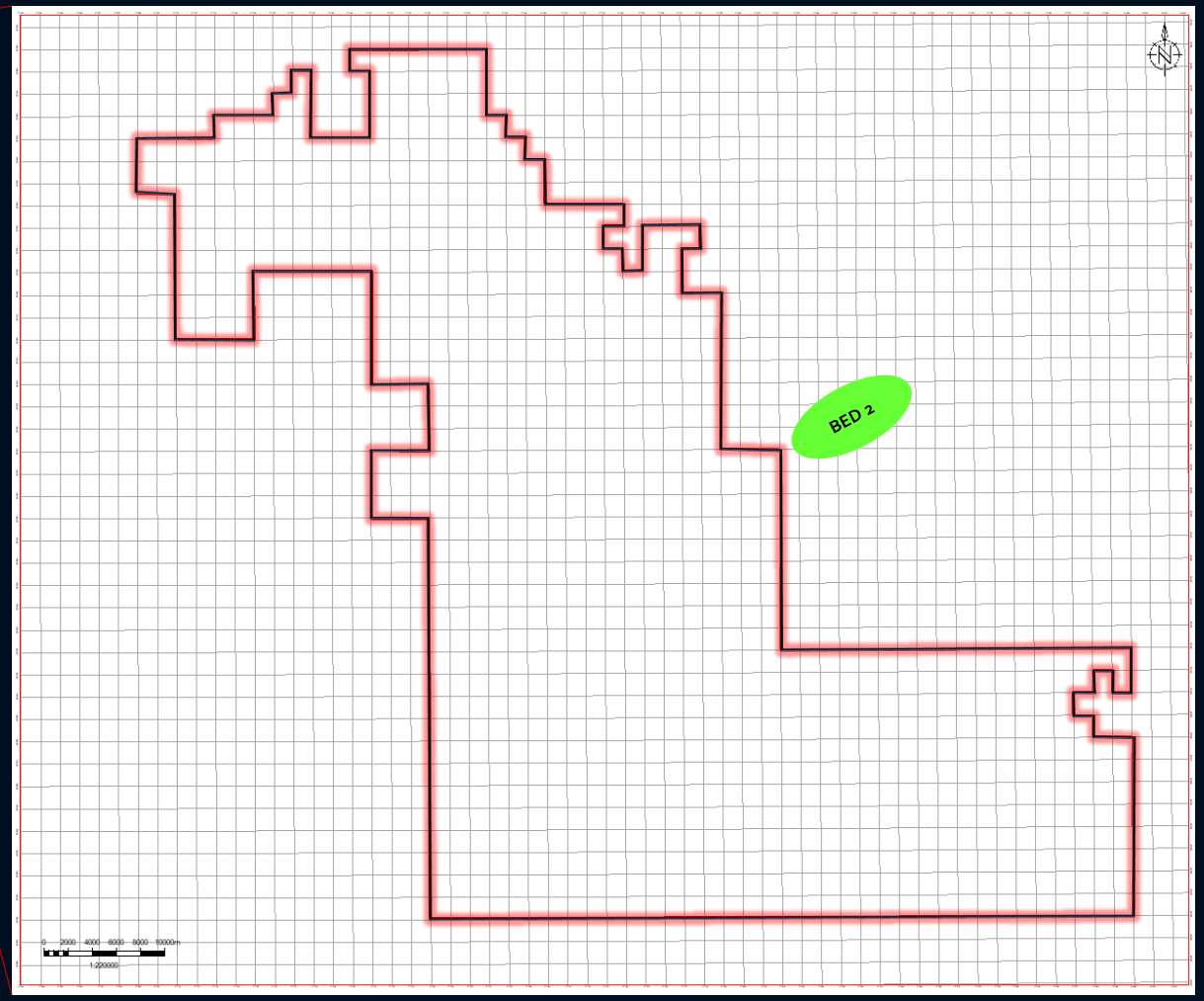
Abu Roash “C” Gas Discovery

ABU EL-GHARADIG BASIN

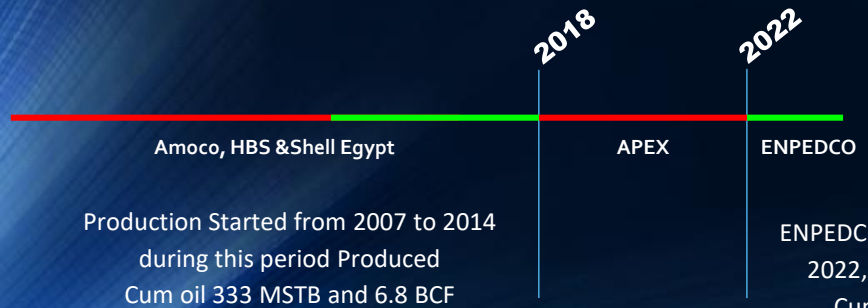
Concession Location & History

- Concession Located in Western Desert.
- Concession is situated to the West of Abu El-Gharadig Basin
- Concession is almost **2700** Km²
- Concession operated by several operators latest were SHELL EGYPT & APEX int.
- Production was established in the concession by former operators
- Concession is surrounded by mature producing fields of BAPETCO
- Surrounding fields producing Oil & gas (Gas facilities existing nearby BED 2)
- **24** wells drilled in the concession, recent **3** wells drilled by the latest operator last well prior ENPEDCO, drilled in **2020**
- Concession was awarded to ENPEDCO by December **2022** though first commercial discovery made by ENPEDCO on June **2022**

Concession Loc. Map



Concession Boundaries

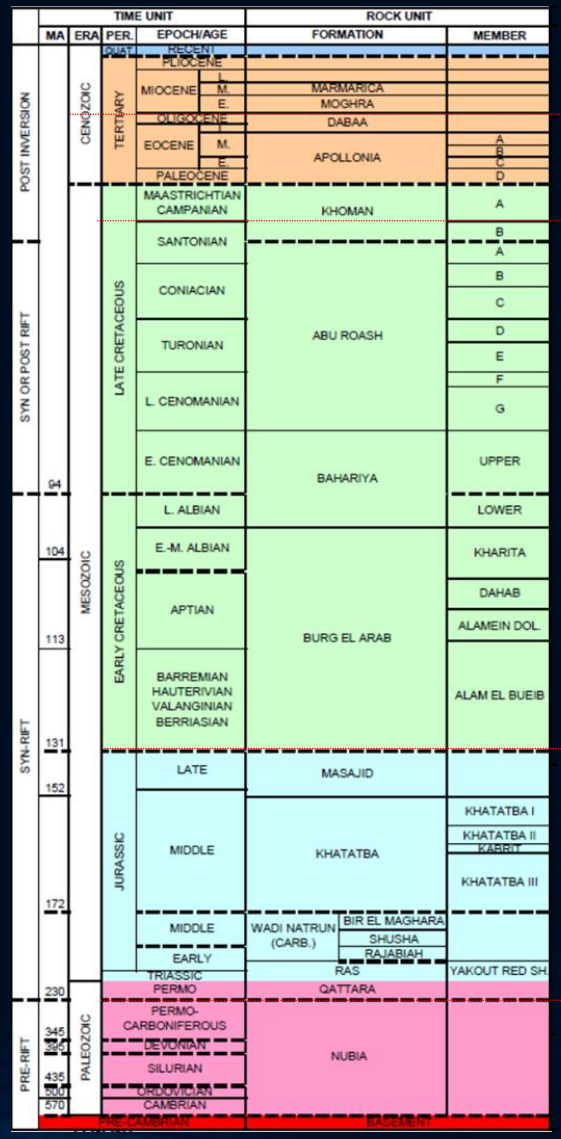


Production Started from 2007 to 2014
during this period Produced
Cum oil 333 MSTB and 6.8 BCF

ENPEDCO started production September 2022, till now produced in one year
Cum oil 473 MSTB and 1.4 BCF

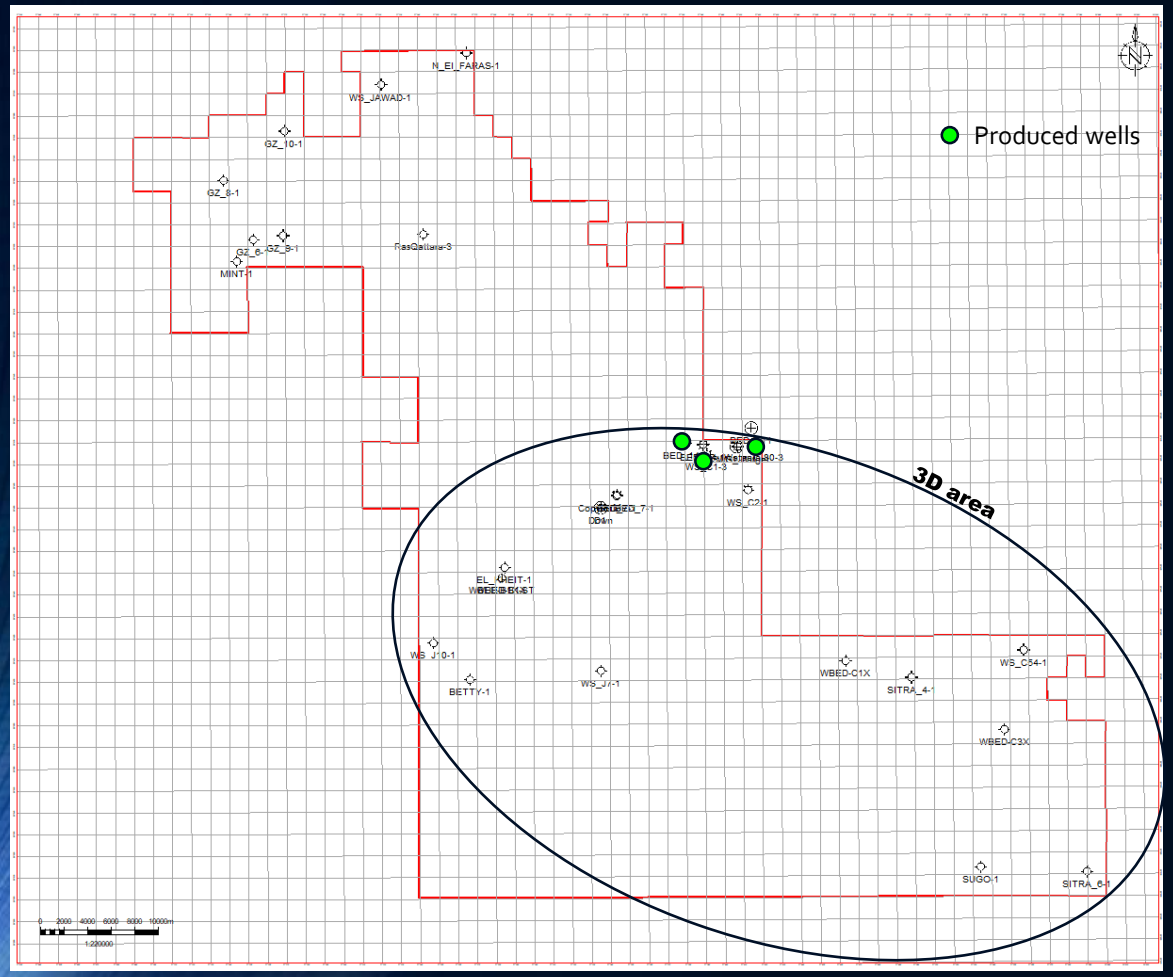
AG Regional Geology & Stratigraphic Column

- Discovered in **1969**, the Abu Gharadig (AG) Field was the first large hydrocarbon discovery in the Abu Gharadig Basin of the Western Desert of Egypt. Oil production began in **1973**, with gas brought into production in **1975**.
- The field produces mainly from upper Cretaceous clastic reservoirs.
- The AG Basin is an E-W trending intracratonic rift basin, about 330 km long and 50–75 km wide.
- It was initially formed as a large half graben basin during the Jurassic time in response to Tethyan rifting and continued to subside throughout the Cretaceous time.
- The half graben was subsequently inverted during the Late Cretaceous as part of the Syrian Arc deformation which affected northern Egypt.
- The Mid-Basin Arch, the AG Anticline, and the Mubarak High are three NE-SW oriented main inversion anticlines located within the AG Basin and are controlled by inversion of pre-existing Jurassic rift faults.
- The AG Anticline has an overall NE-SW orientation with a gentle plunge towards the NE and SW. It is locally bounded by two NE–SW-trending inverted faults on the southwest and northeast, accounting for the asymmetry of the anticline. Reverse offset of Cretaceous horizons is obvious at these inverted faults.
- Fault propagation folding is developed above the tips of the inverted faults at the Late Cretaceous Abu Roash and Khoman Formations
- inversion started during the Santonian time and continued into the Campanian-Maastrichtian. Inversion continued during deposition of the Paleocene–Middle Eocene Apollonia Formation and the Late Eocene–Oligocene Dabaa Formation

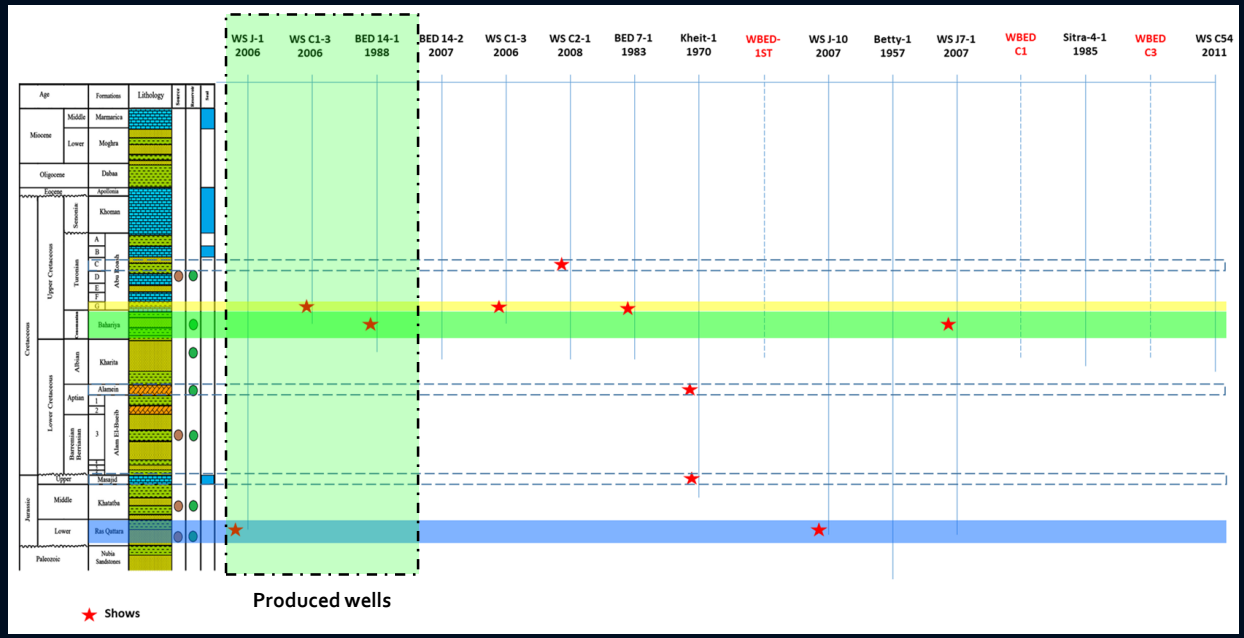


WD Stratigraphic column

South Ras Qattara Concession Wells Analysis



Wells drilled in the concession



Reported shows in the wells & producing wells

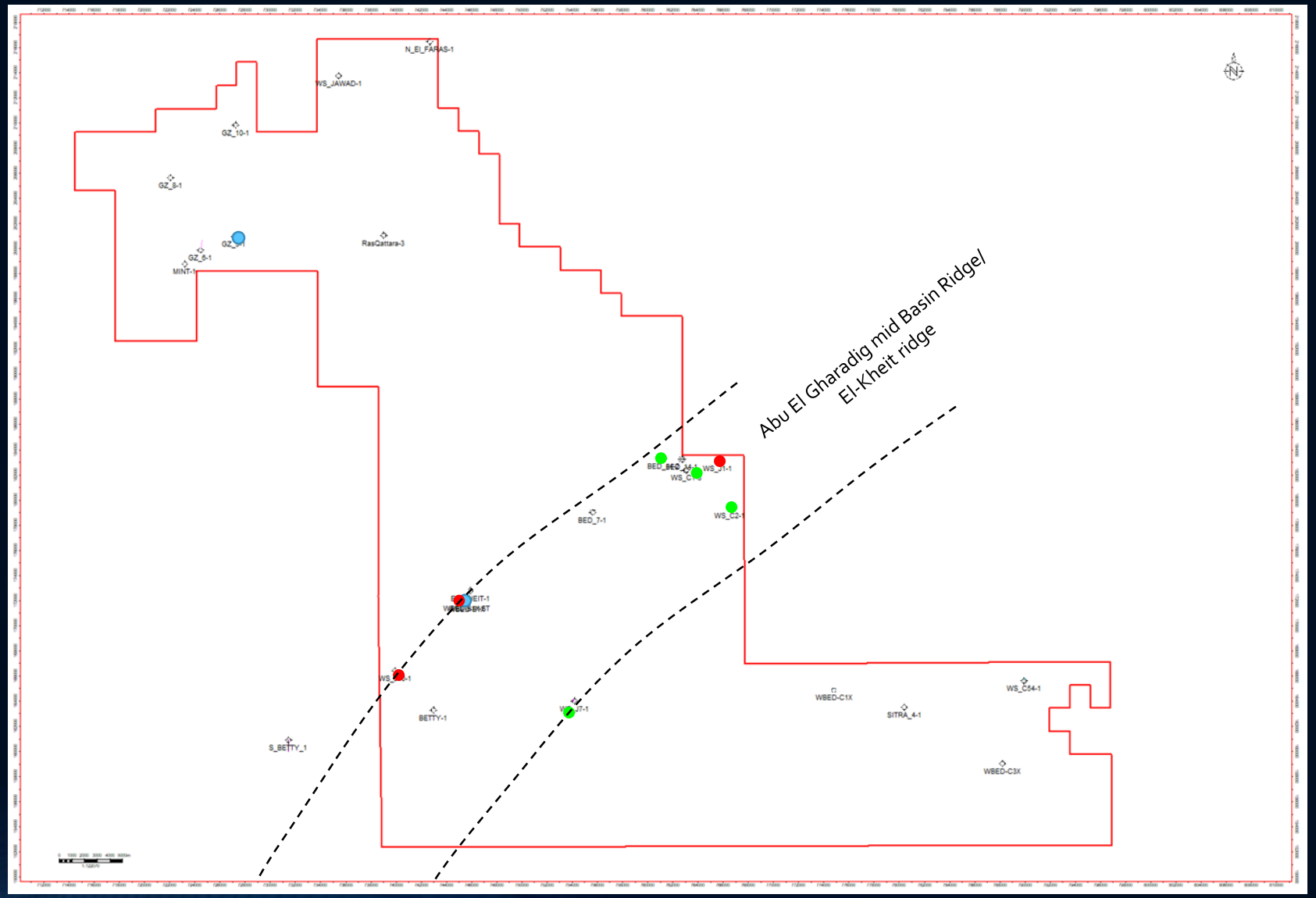
- **16** wells out of the **24** drilled in the Southern part of the concession (Coverd by **3**D) .
- Shows reported in most of the wells all over the stratighraphic column down to JU.
- Three wells produced Oil, Condensate & Gas by former operators (**2** wells Bahariya fm. & **1** well Jurassic)
- Cum oil 333 MSTB and 6.8 BCF

South Ras Qattara Wells Analysis

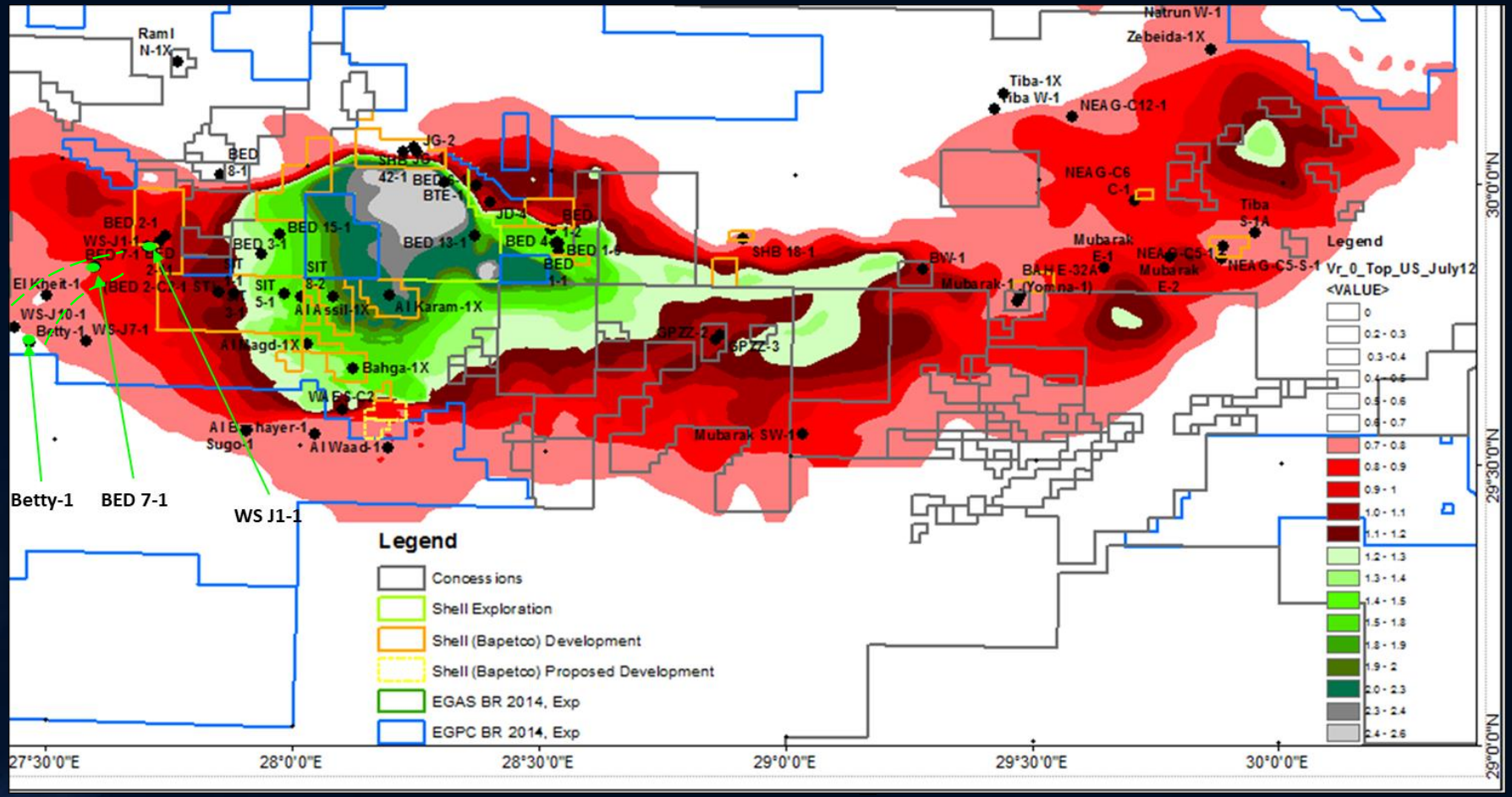
AEB Shows
- GZ-6
- El-Kheit-1

Jurassic Shows
- El-Kheit-1
- WS J-1
- WS J-10

Cretaceous Shows
- BED 14-1 & 2 " Bahariya "
- WS J7-1 " Bahariya "
- WS C1-3 " AR/G "
- WS C2-1 " AR/C "



Abu El-Gharadig Source Rock Maturity Map (After SHELL)



*-Khataba SR facies vary from Oil prone SR in the eastern part of the basin to be a be a gas prone SR in the western part of the basin

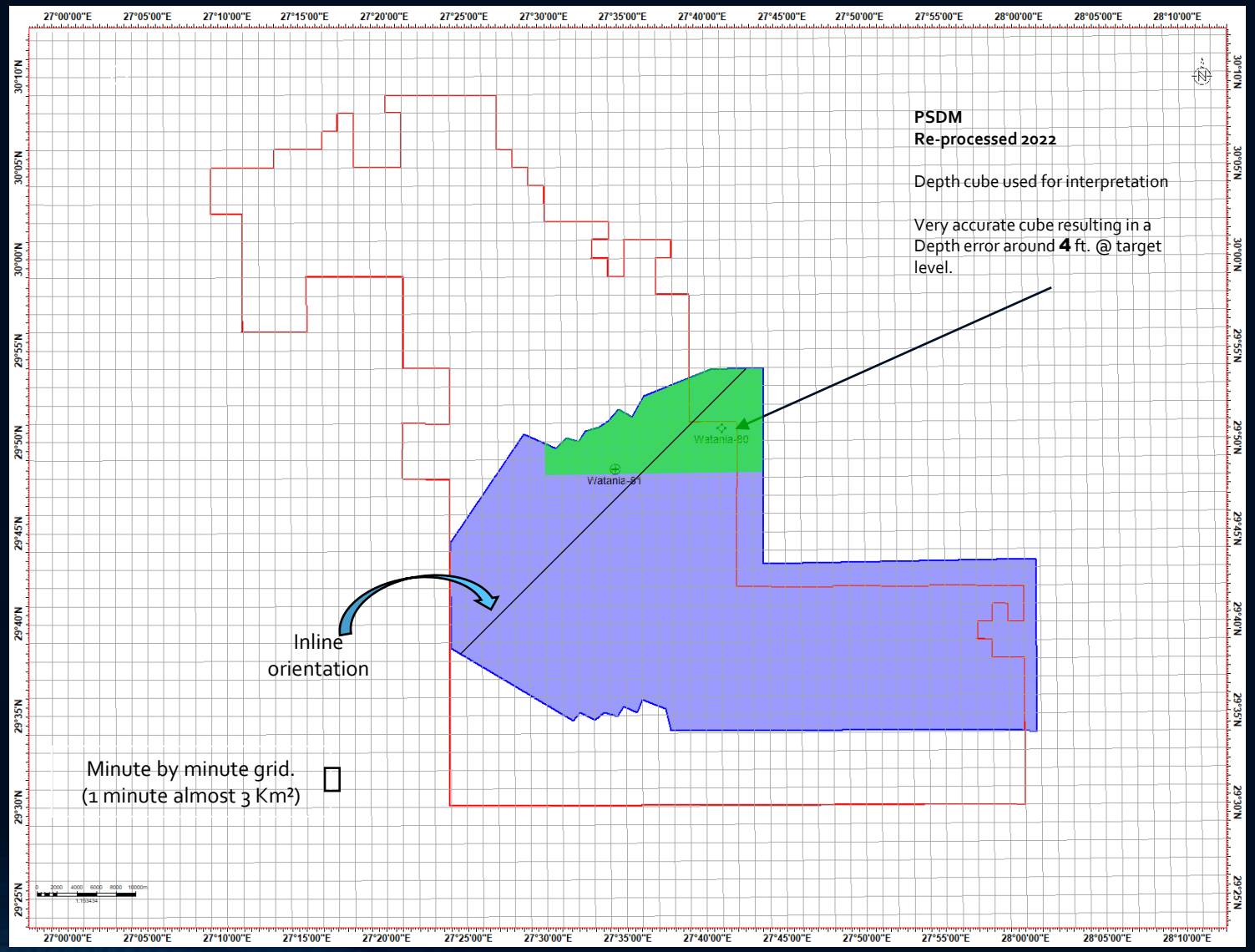
*-Khatatba is the main SR interval generate the Gas in many of the big gas acclamations in AG basin (BED 2 , Al Karam , Al Assil)

*-Khatatba is the main SR interval generate the Gas in many of the big Oil acclamations in AG basin (Youmna , NEAG C_3 and NEAG C_4)

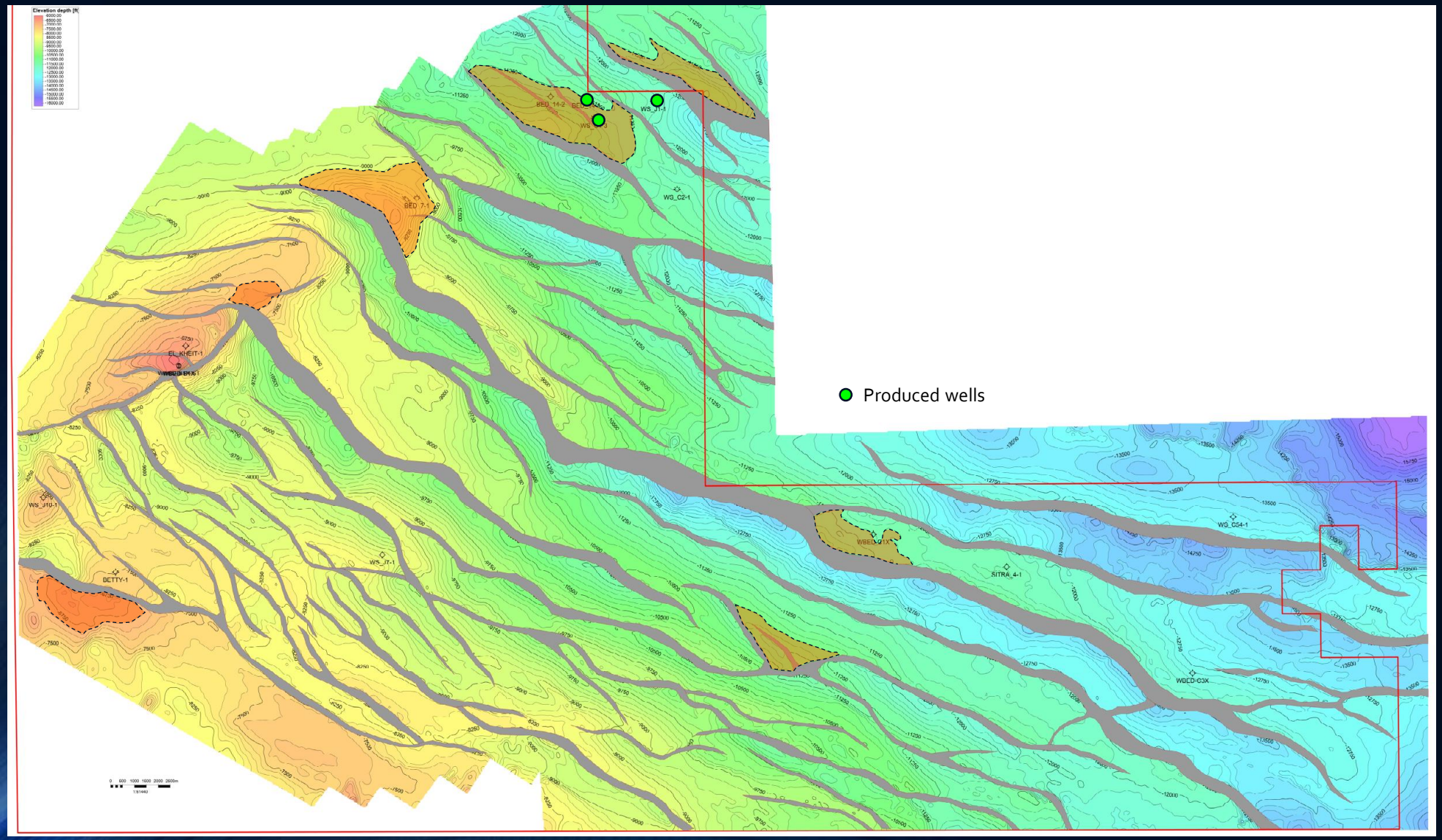
South Ras Qattara Concession Seismic Coverage

Sequence		Description/Jusitifcation
Pre-processing		
1)	Reformat field format to internal processing format	
2)	Geometry application	
3)	Remove recording system filter	
4)	SEGY archive of shot gathers with geometry	For future use / instead starting from Raw without navigation.
5)	Minimum Phase Conversion	
6)	Spherical divergence gain correction	To compensate Amplitude loss.
7)	Despike noise attenuation may be applied in common source and/or common-offset or receiver domain and/or other domain as required. In addition to Shot and channel edits (up to 3 passes)	The land data in general, and western desert in particular is noisey, and considerable effort need to be invested in this process.
8)	Coherent noise attenuation (up to 2 passes)	Same as above.
9)	Dispersive noise removal (source generated noise, etc.) - if applicable	Not applicable for conventional data - but needed for high density shooting (future use).
10)	High-Resolution Linear Radon, Tau-P, frequency dependent noise attenuation and adaptive ground role noise attenuation. Interpolation to de-alias noise attenuation may be needed prior to this step.	Aiming to eliminate multiples.
11)	Attenuation of scattered ground roll and other wave modes - if applicable	Not applicable for conventional data - but needed for high density shooting (future use).
12)	Refraction / Tomographic statics as appropriate	
13)	3D Multiple attenuation (for surface- and inter-bed multiples), may need to interpolate and/or regularize data prior to the application - if applicable	Depending on the available well data and identifying clearly the multiple genereators
14)	Phase only inverse Q, surface consistent Deconvolution	
15)	Surface consistent amplitude correction – using components: shot, receiver and offset to be tested	Testing and application based on the data (i.e. 1st 2 component for friendly amplitude approach, applying offset if looking for pre structural image)
16)	1st Pass velocity analysis 0.5 x 0.5 km (including any data pre-conditioning)	
17)	Iterative Residual Statics application (up to 2 passes)	
18)	5D regularization and interpolation – if needed	Improve data quality / filling gaps - application based on the data and azimuth distrubution
19)	3D OVT binning – if applicable	Application based on the data and azimuth distrubution
20)	SEGY archive of CMP ordered gather data on tape in SEGY format.	For future use / for any re-migration
21)	PreSTM	
22)	2nd Pass velocity Analyses, 0.5 x 0.5 km (including any data pre-conditioning)	
23)	Target line Kirchhoff PSTM every 1km for velocity analysis	
24)	3D velocity model building including tomographic velocity analysis.	
25)	Anisotropic PreSTM (if applicable).	Based on data behaviour
26)	3D High Resolution Radon demultiple – if needed	Aiming to eliminate multiples.
27)	SEGY archive of raw PreSTM gathers, no NMO applied, on tape in SEGY format.	
28)	Residual velocity analysis and/or trim statics and/or ETA corrections may be required for optimal resolution at 250 x 250m spacing	
29)	SEGY archive of final NMO PreSTM gathers on tape in SEGY format.	Final Deliverables
30)	Generation of full angle stacks.	
31)	SEGY archive of raw stack volume	
32)	Supergather noise attenuation, applied to full stack volumes	
33)	Post Stack Processing, applied to full stack volumes	Post Stack Enhancements
34)	Phase matching	Post Stack Enhancements
35)	Time Variant Filter and Scaling	Post Stack Enhancements
36)	SEGY archive of post processed full stack volume.	Final Deliverables
37)	Velocity model	
38)	Velocity Model Building & PreSDM	
39)	Initial Velocity Model and up to 4 – 5 velocity updates/iterations	4 - 5 iteration is adequet number of iterations to reslove the sediments, carbontes and any low/high velocity anaomlies
40)	Anisotropic PreSDM.	
41)	SEGY archive of raw PreSDM gathers, no NMO applied, on tape in SEGY format.	Archiving / Final Deliverables
42)	SEGY archive of raw PreSDM gathers, no NMO applied - converted to time, on tape SEGY format.	Archiving / Final Deliverables
43)	SEGY archive of raw RTM gathers, on tape in SEGY format.	Archiving / Final Deliverables
44)	High resolution Radon demultiple	Aiming to eliminate any remenat multiples.
45)	Residual velocity analysis at 250 x 250m spacing	
46)	SEGY archive of final NMO PreSDM gathers with anisotropic corrections, on tape in SEGY format.	Archiving / Final Deliverables
47)	SEGY archive of raw stack volume	Archiving / Final Deliverables
48)	Supergather noise attenuation, applied to full stack volumes.	Archiving / Final Deliverables
49)	Generation of full angle stacks.	QC Stacks
50)	Post Stack Processing applied to full stack volumes.	Post Stack Enhancements
51)	Time Variant Filter and Scaling	Post Stack Enhancements
52)	SEGY archive of post processed full stack volume	Final Deliverables
53)	SEGY archive of PSDM velocity model	Final Deliverables
54)	Comprehensive processing report.	Final Deliverables

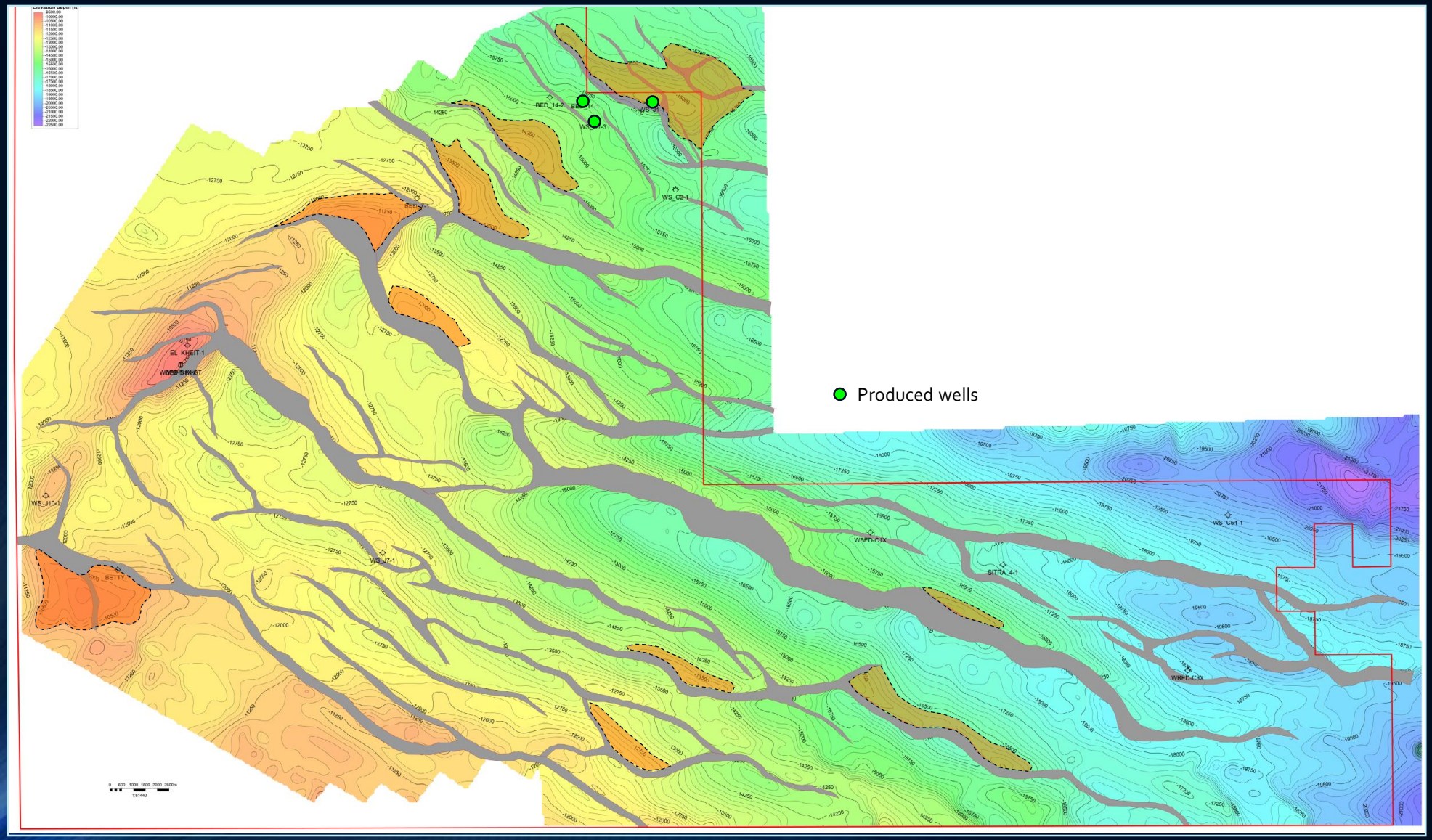
Re-processing applied sequence & each step justification



Top Alam El-Buieb Depth Map

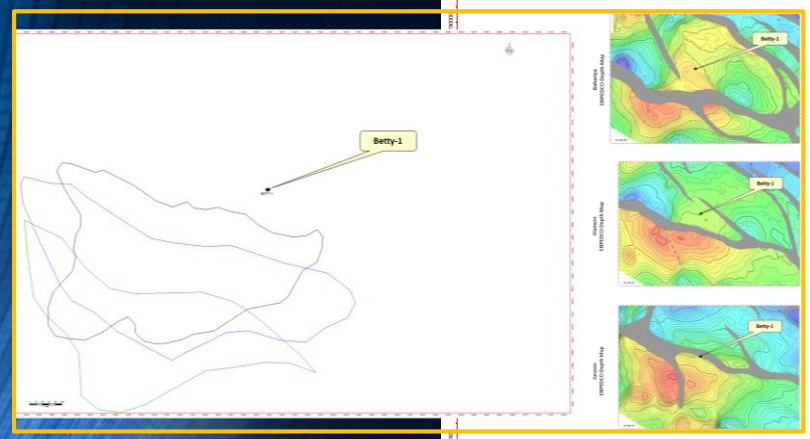


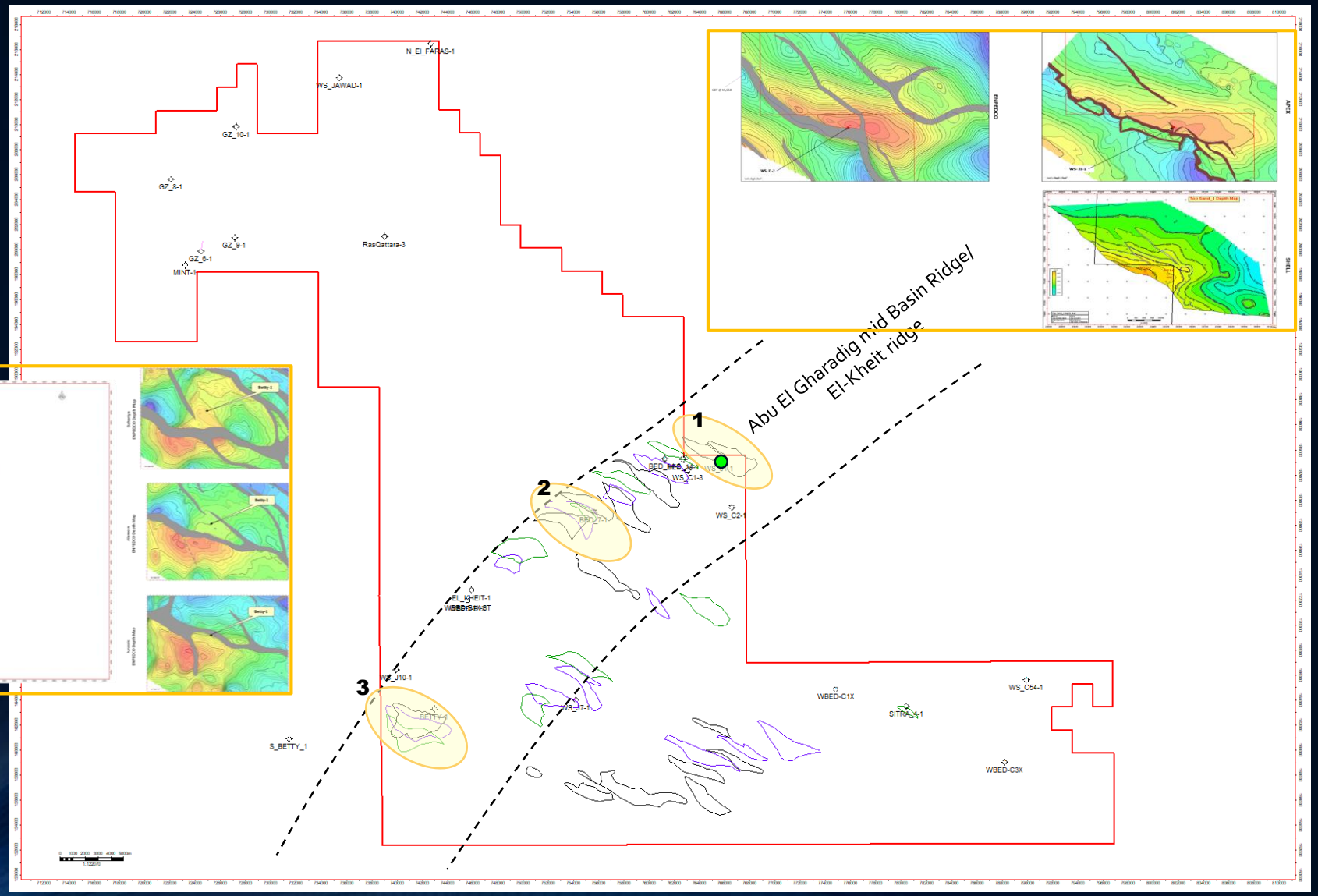
Top Jurassic Depth Map



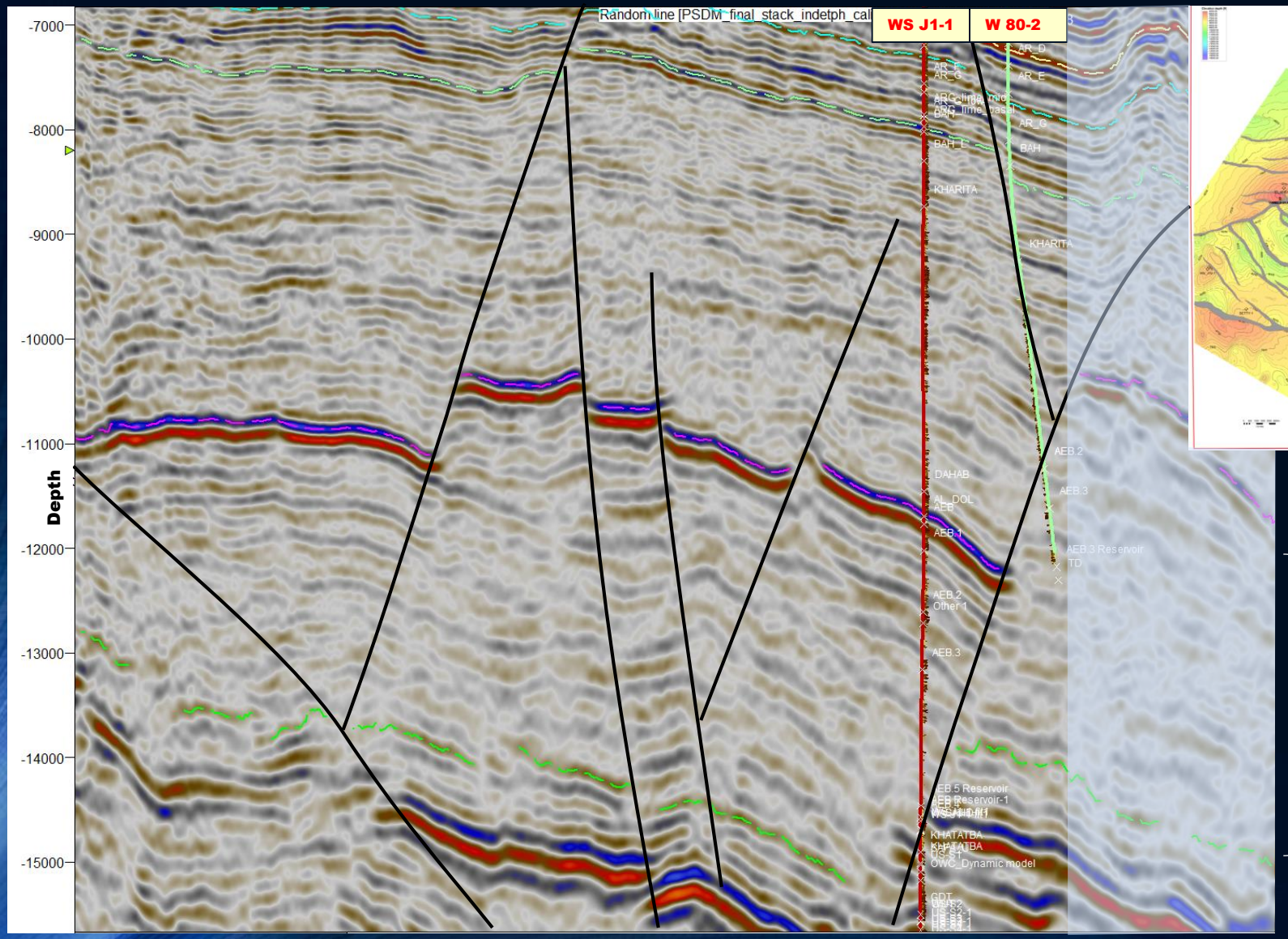
South Ras Qattara Concession 3D Defined Leads

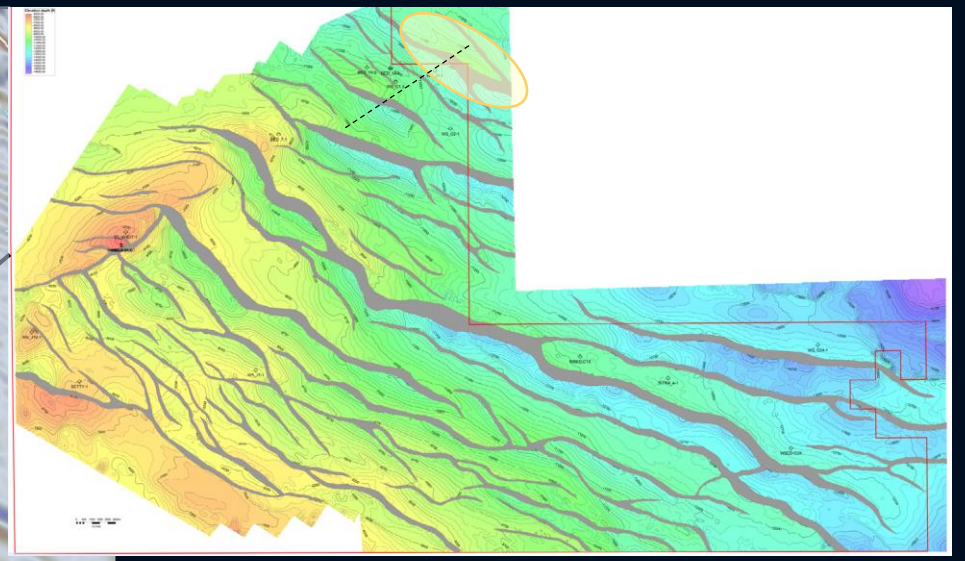
- Bahariya Leads
- Alamein Leads
- Jurassic Leads





Unlocking Alam El-Buieb Approach



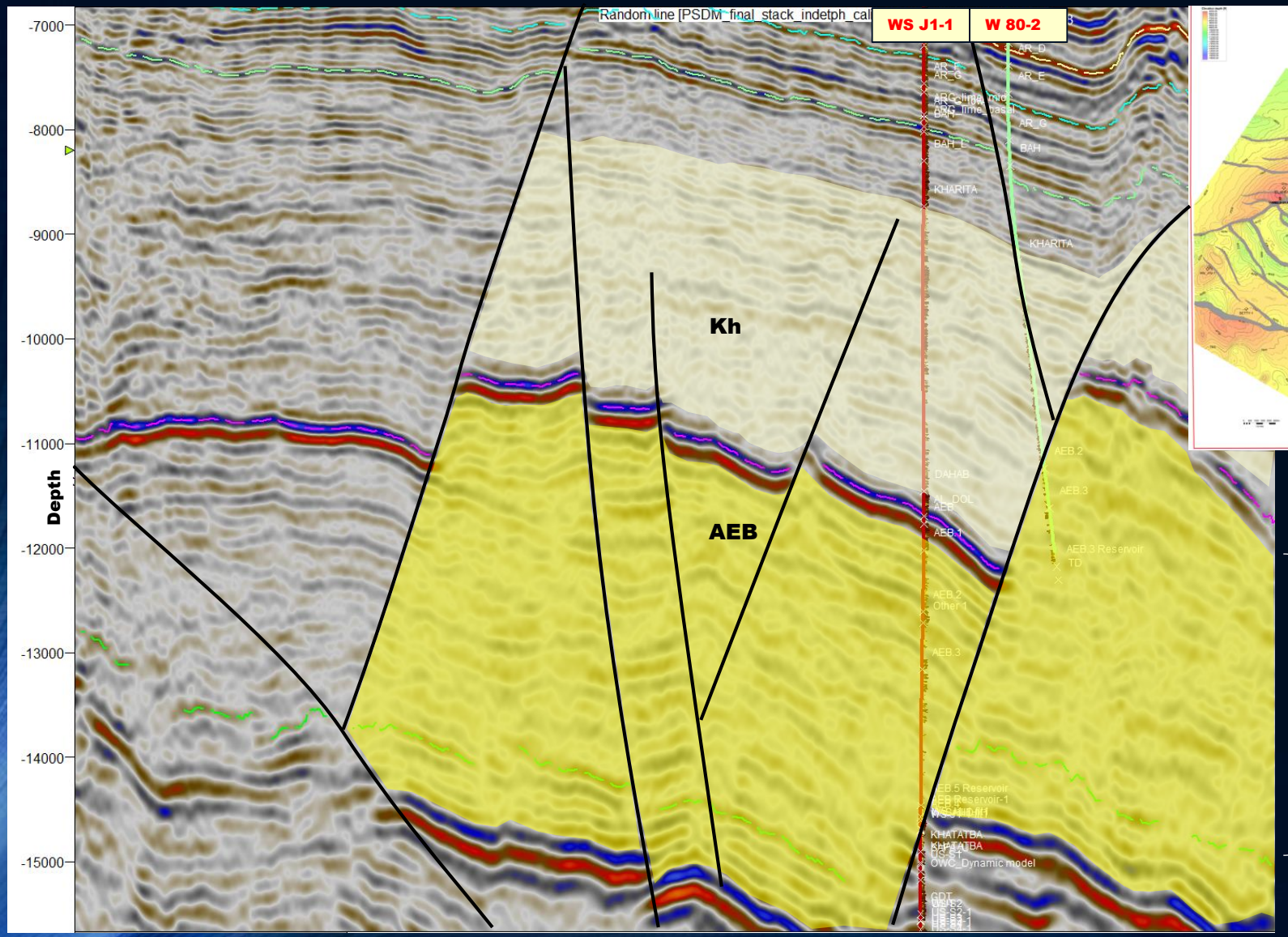


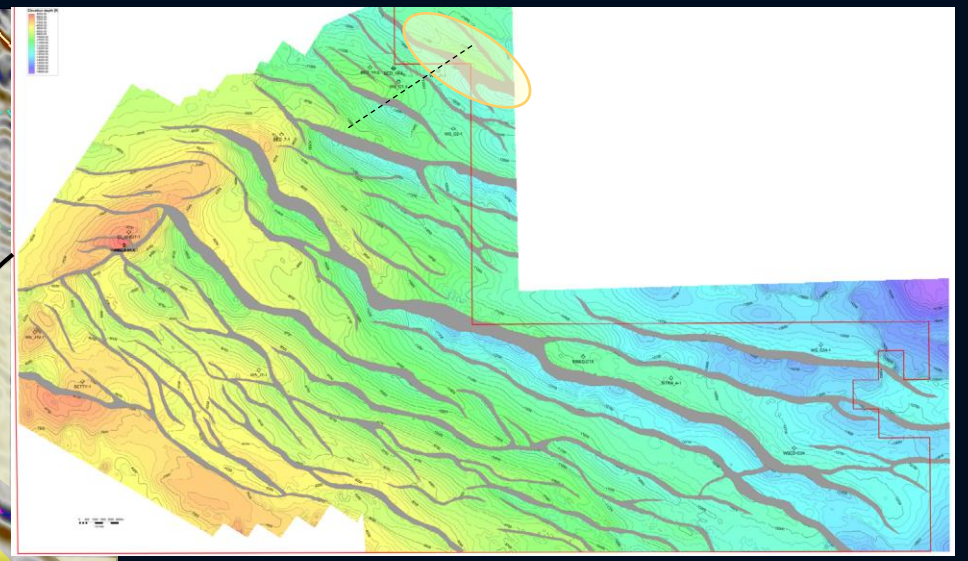
Block of interest following results of WS J-1 well & re-interpretation results.

A secondary target was set to be AEB but juxtaposition problem ?!

- **Juxtaposing Both Kharita & AEB on the downthrown side**

Unlocking Alam El-Buieb Approach



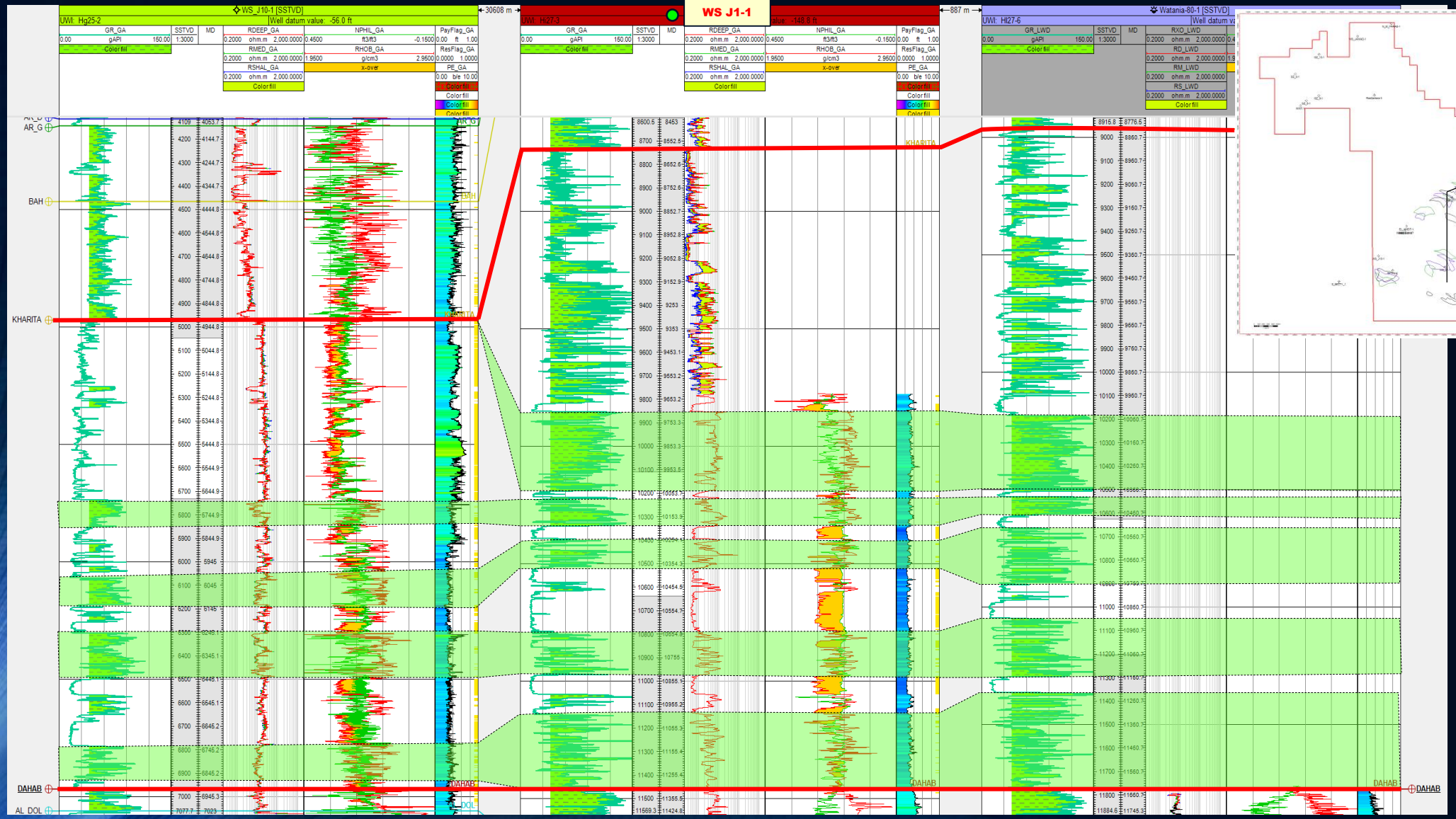


Block of interest following results of WS J-1 well & re-interpretation results.

A secondary target was set to be AEB but juxtaposition problem ?!

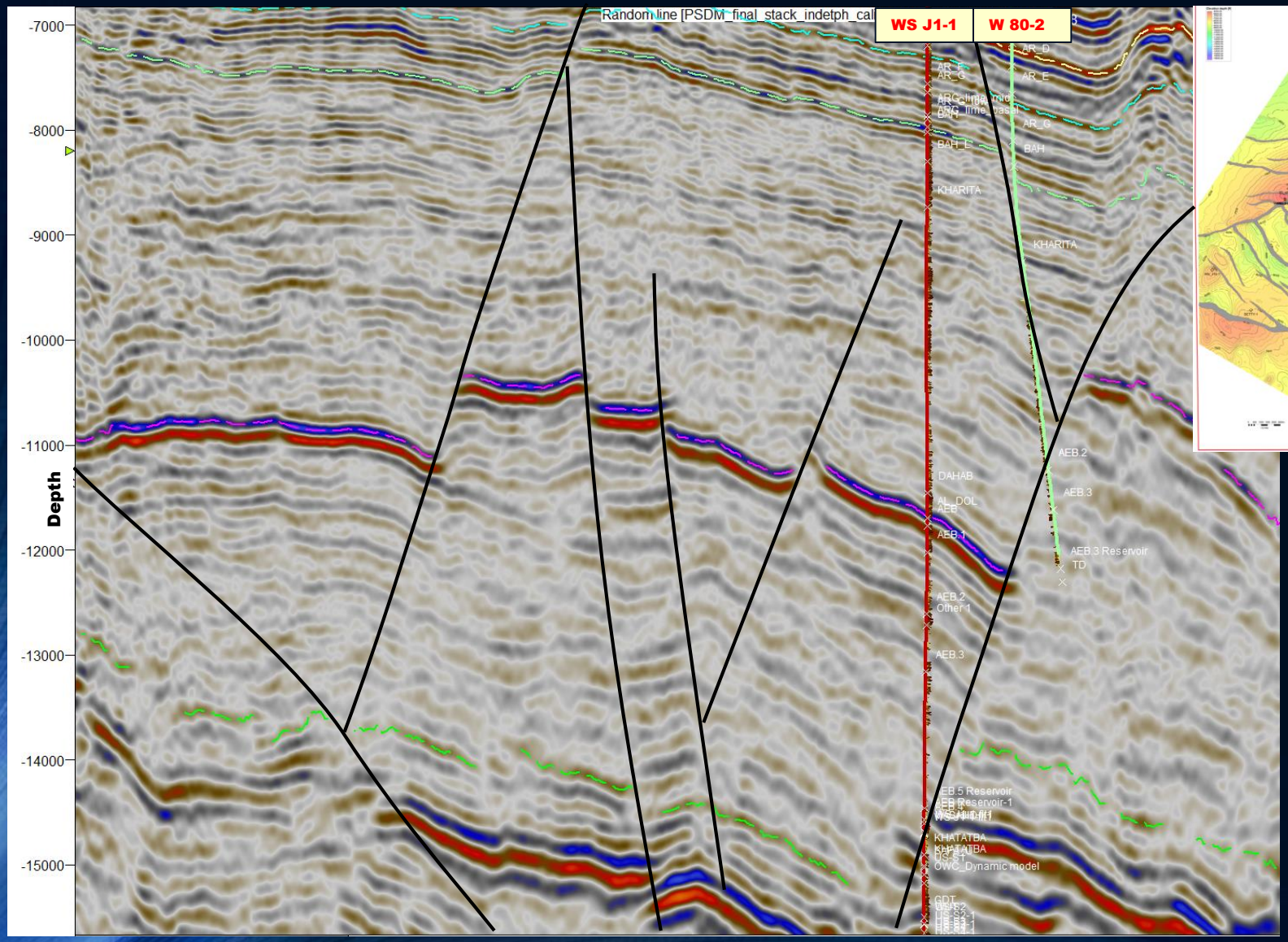
- **Juxtaposing Both Kharita & AEB on the downthrown side**

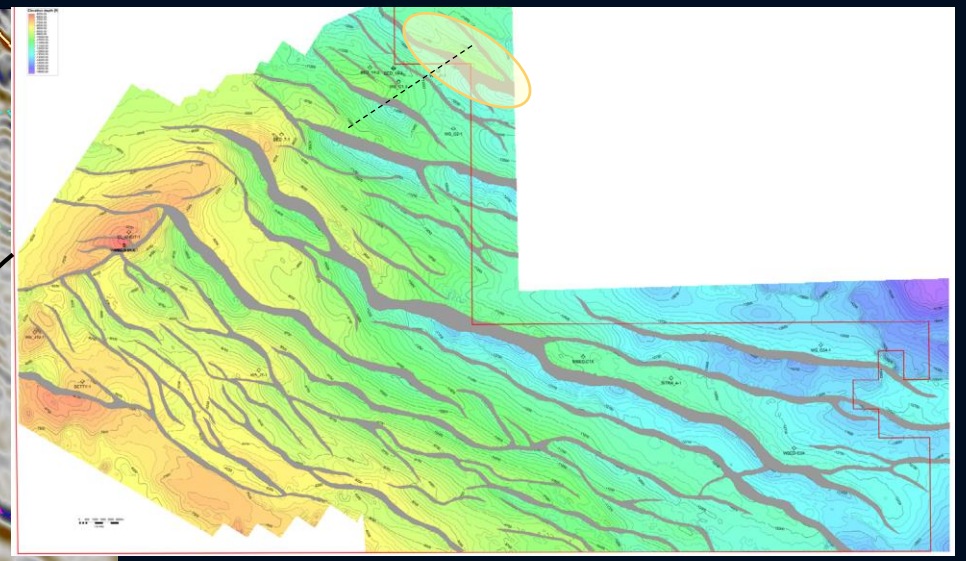
Kharita Shale Correlation



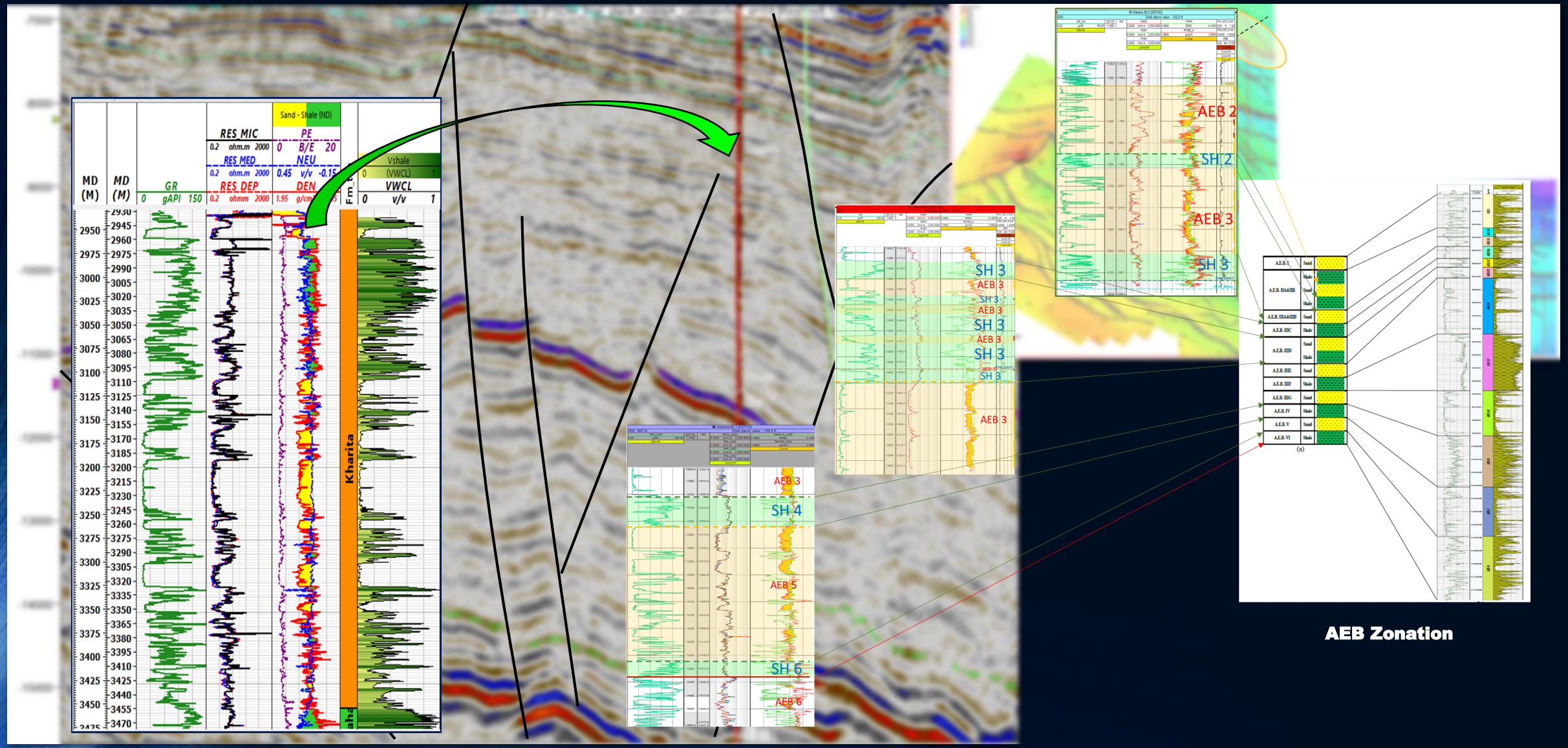
- Down thrown side well WS J1-1 showing Kh. Lower part to be more shaley.
- Lower Kh. More shaley in the wells in the concession
- Correlated shales in Kh. Formation specially lower section
- Marked to be interpreted over seismic

Unlocking Alam El-Buieb Approach



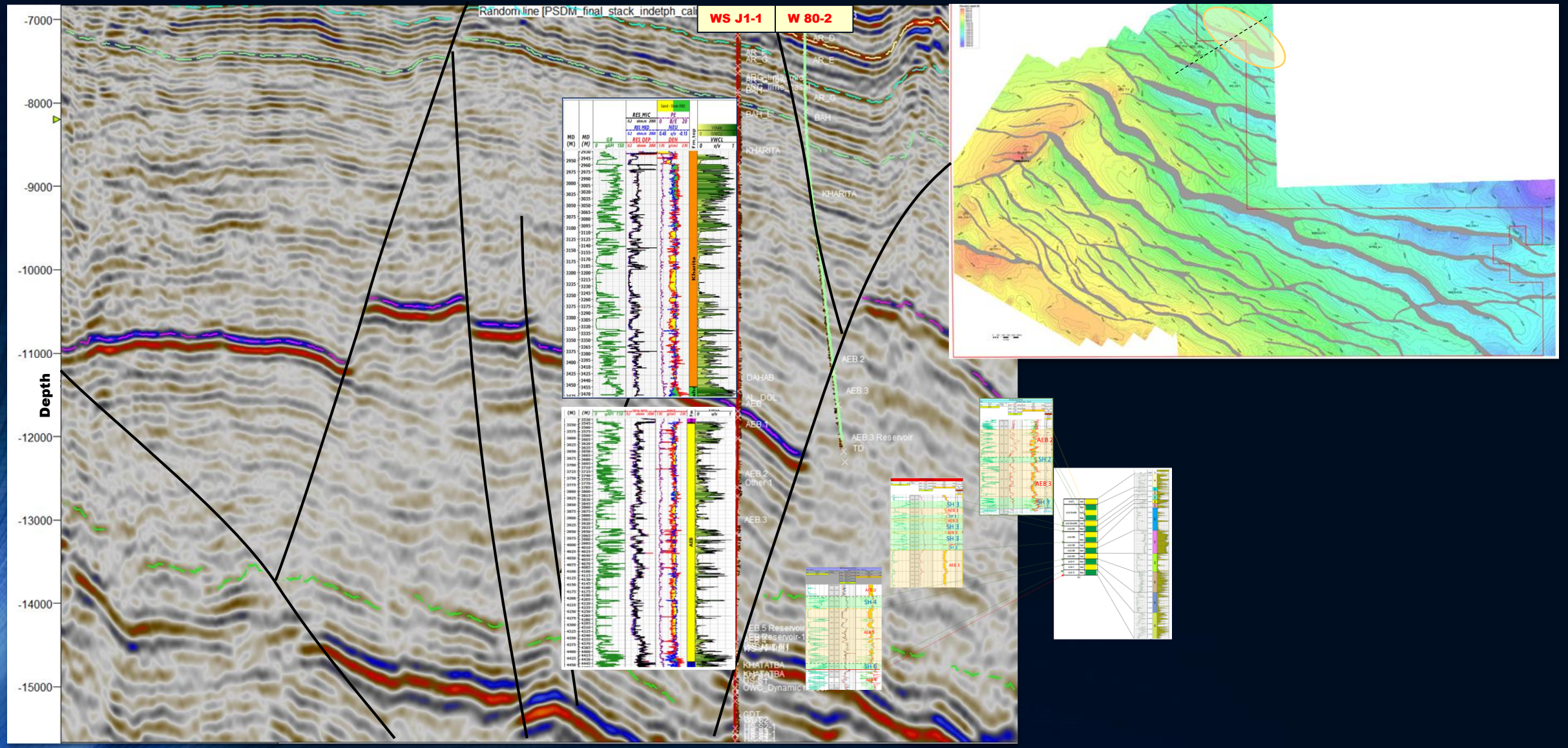


Unlocking Alam El-Buieb Approach

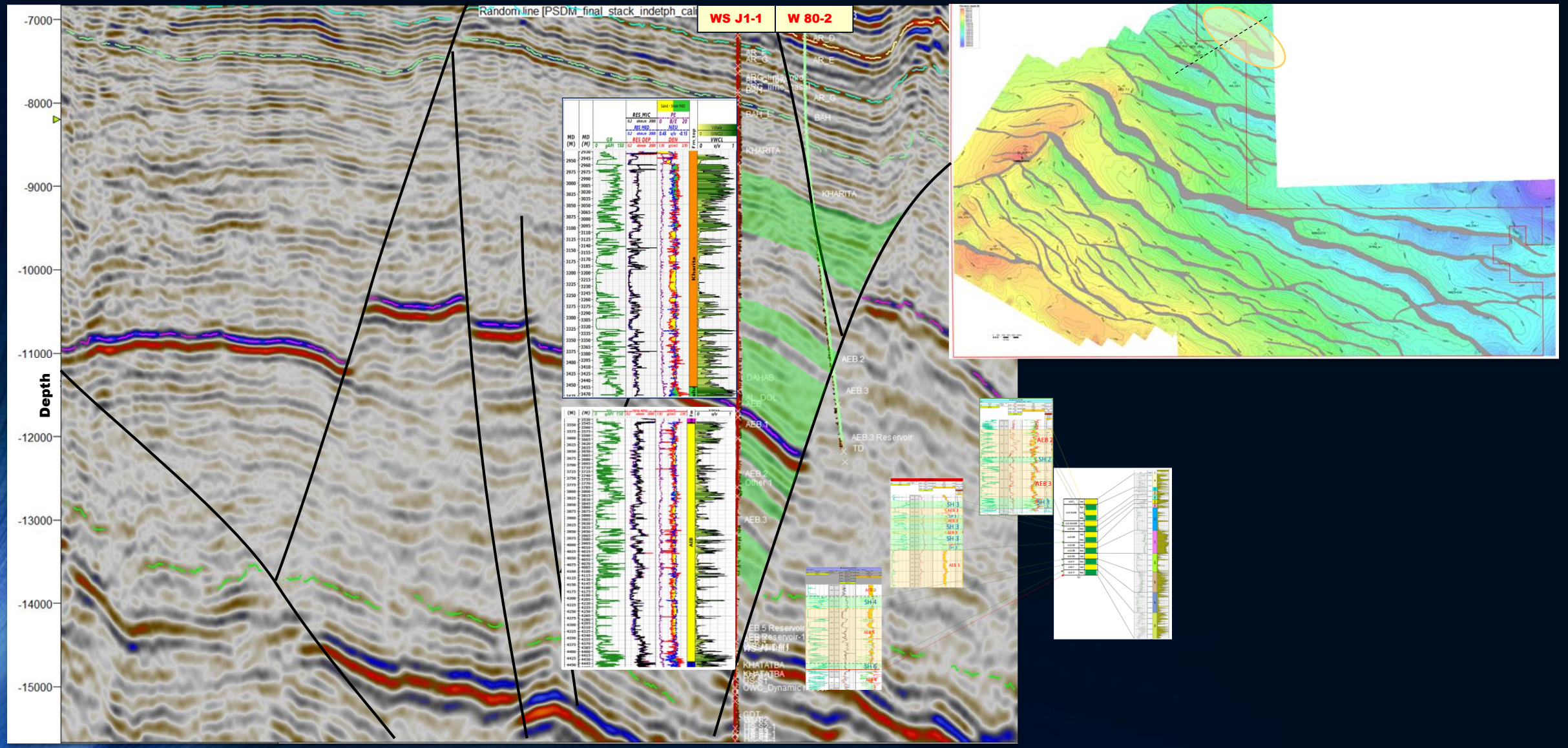


AEB Zonation

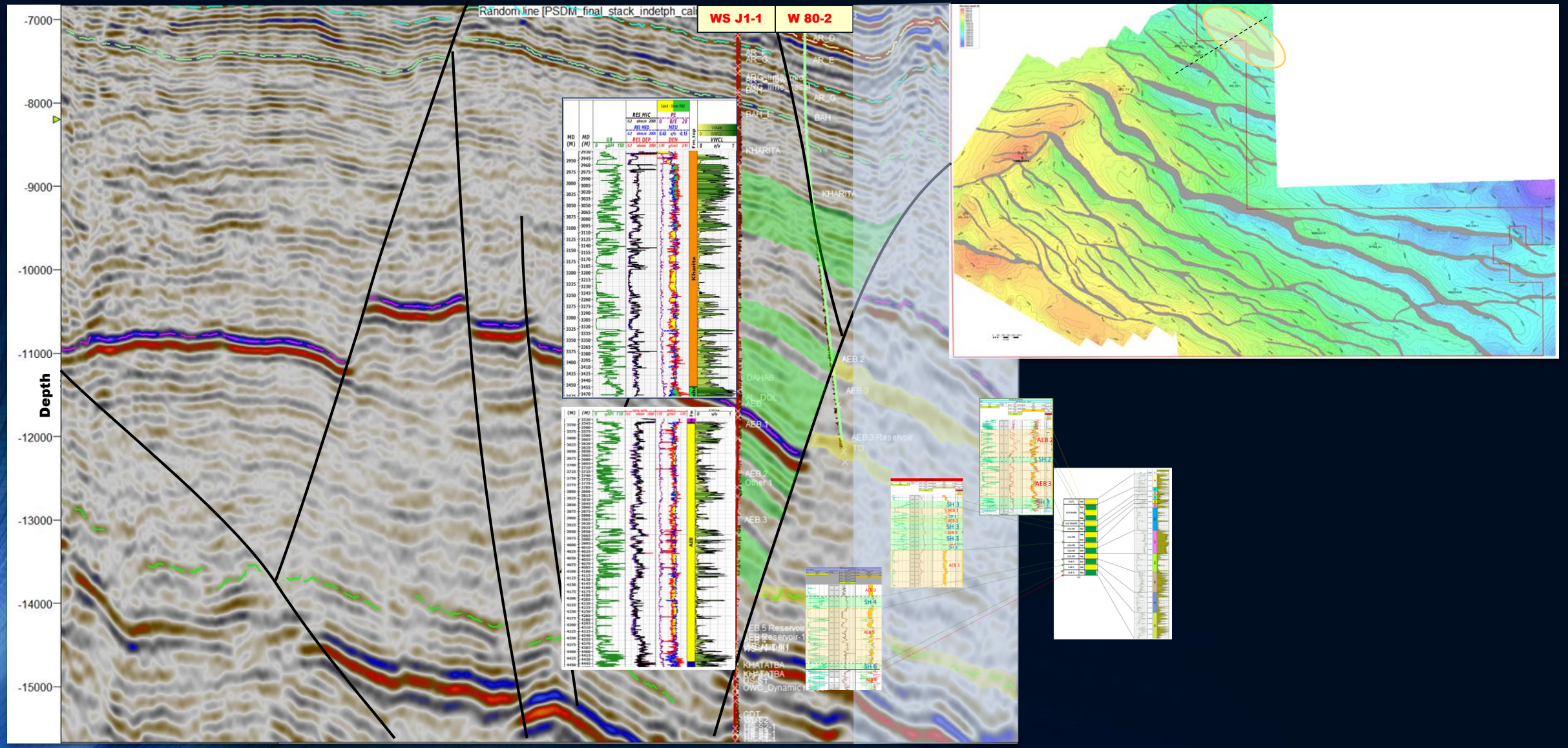
Unlocking Alam El-Buieb Approach



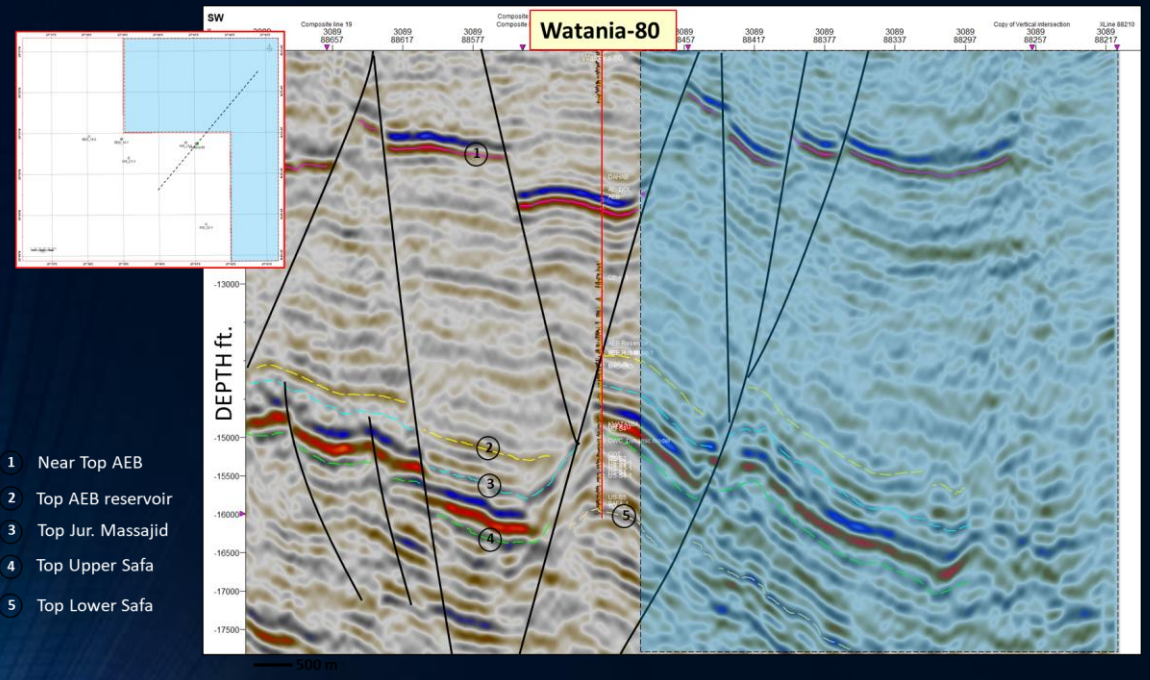
Unlocking Alam El-Buieb Approach

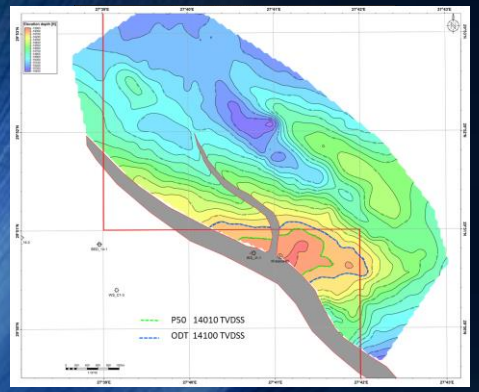


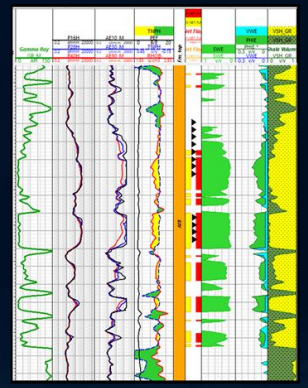
Unlocking Alam El-Buieb Approach



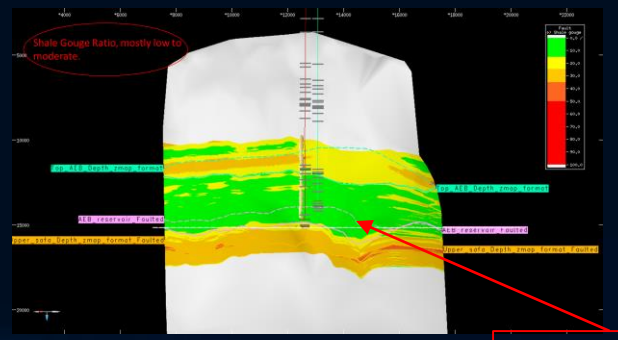
Watania-80 AEB (Unit 5) Play Opener Summary





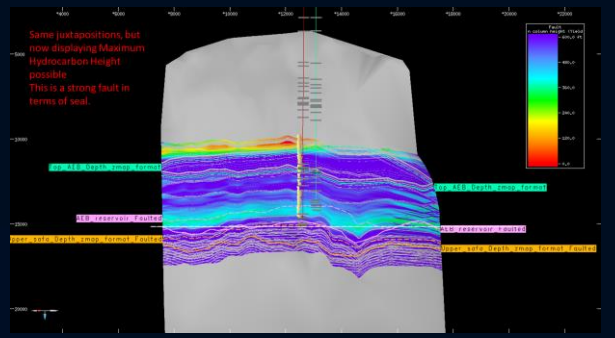


77 Ft net pay,
10 % average porosity,
22% water saturation



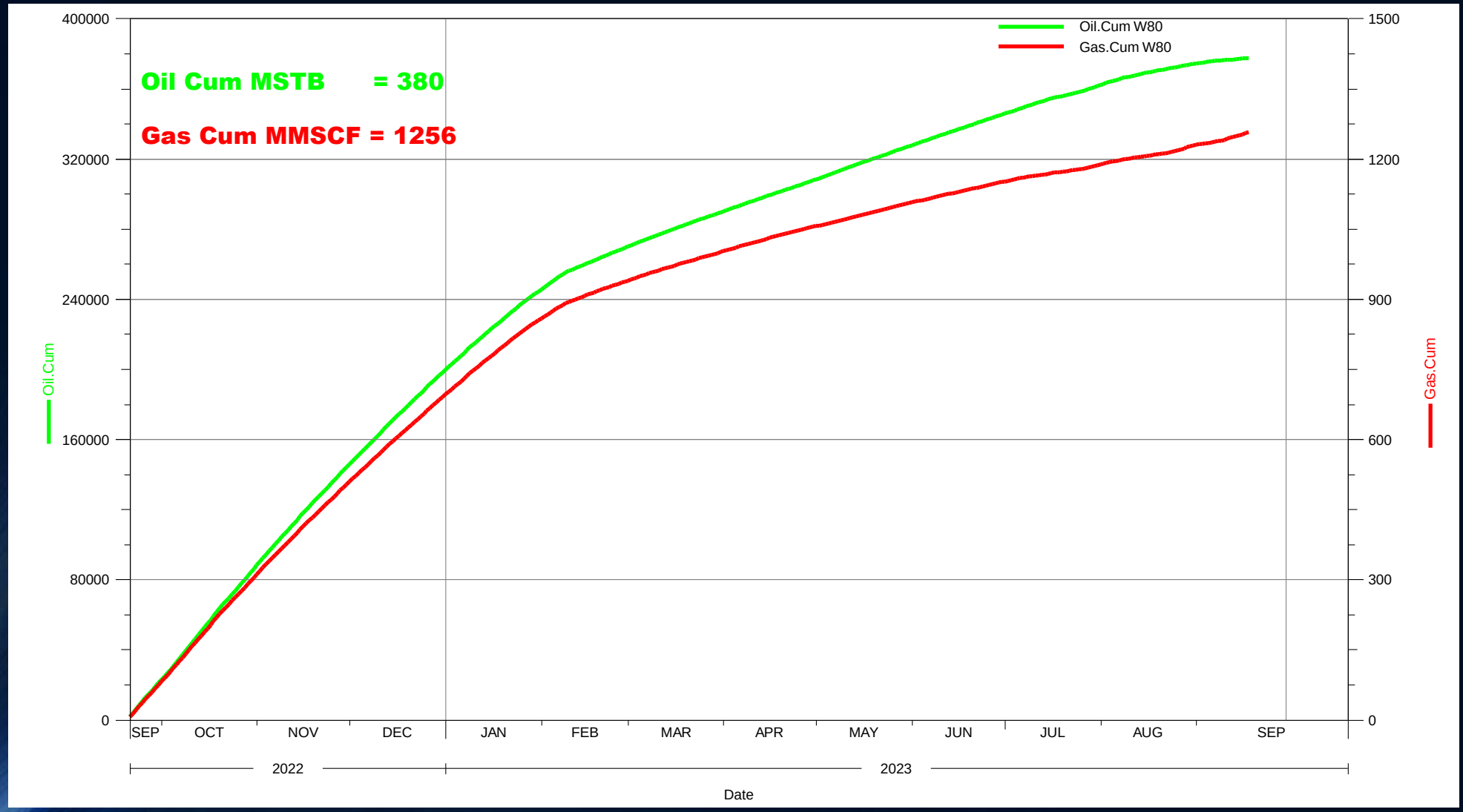
Shale gauge ratio along fault plane

Another good sealing zone along same fault for AEB units **2&3**

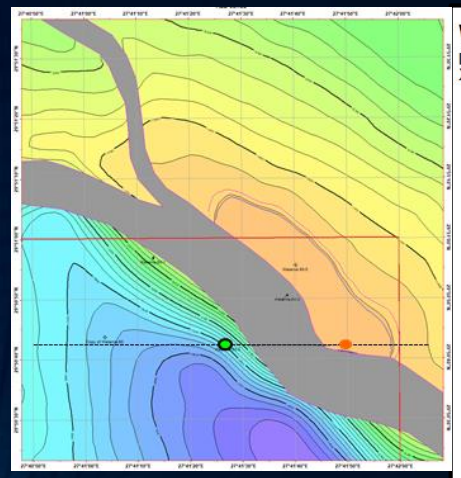


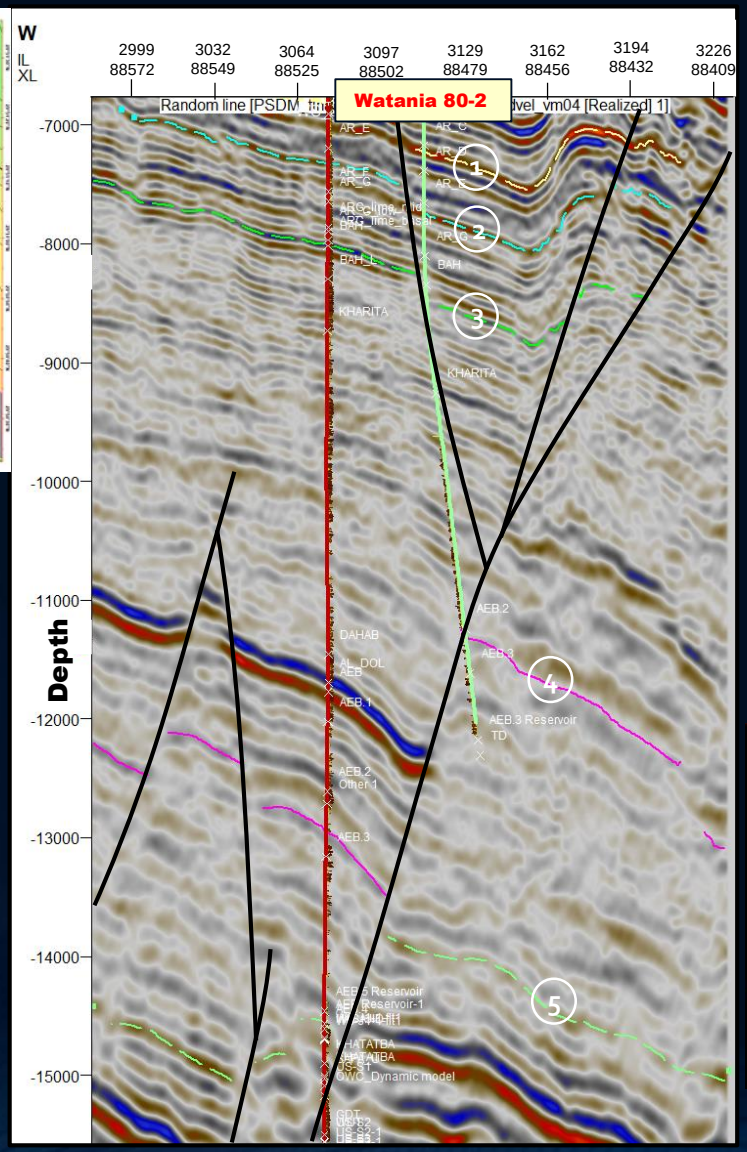
Hydrocarbon column prediction

Watania-80 AEB (Unit 5) Production Chart

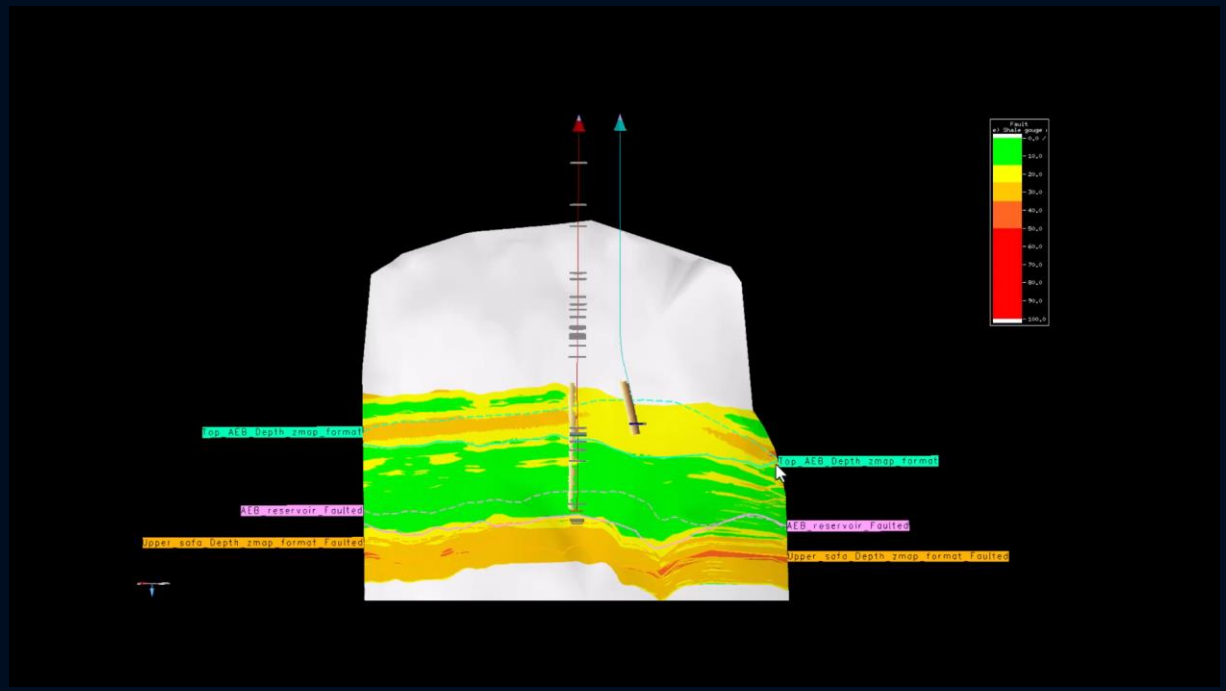


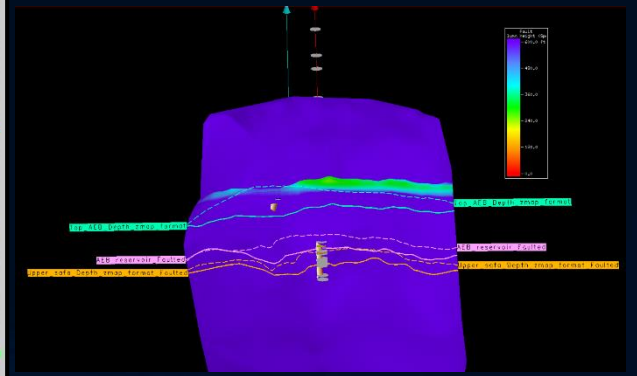
Watania 80-2 AEB (Unit 2) Success Case



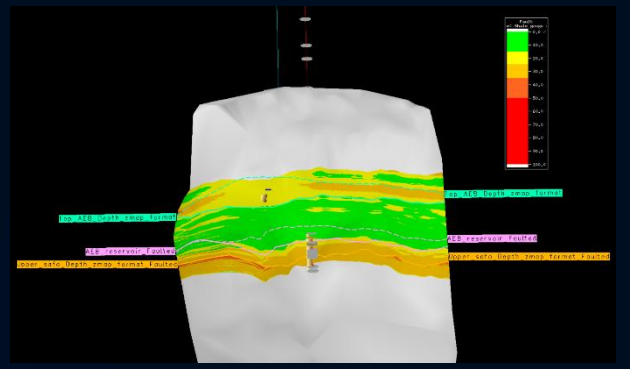


1. ARC
2. ARE
3. Top Bahariya
4. AEB Unit 2 Reservoir
5. AEB Unit **5** Reservoir



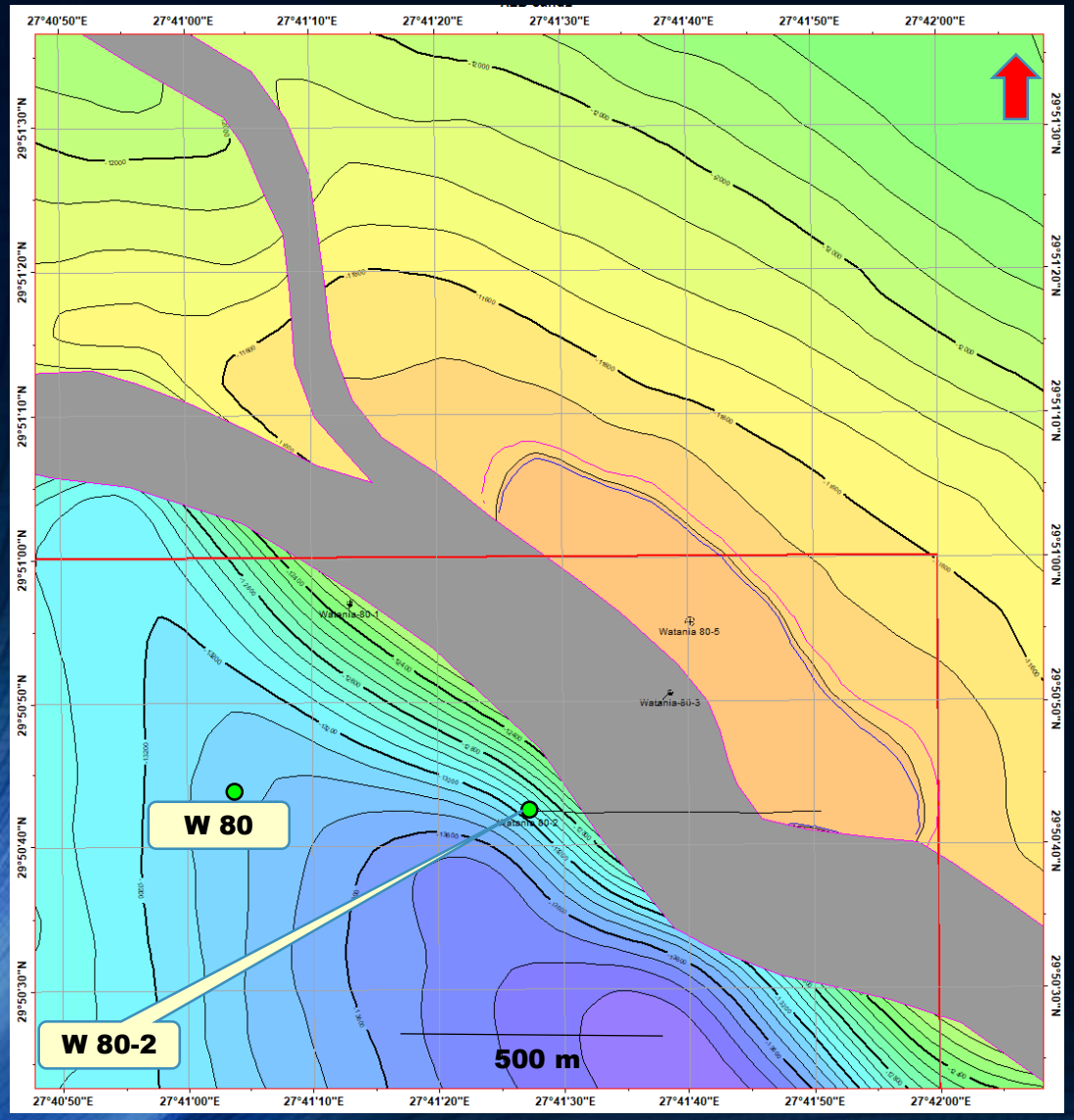


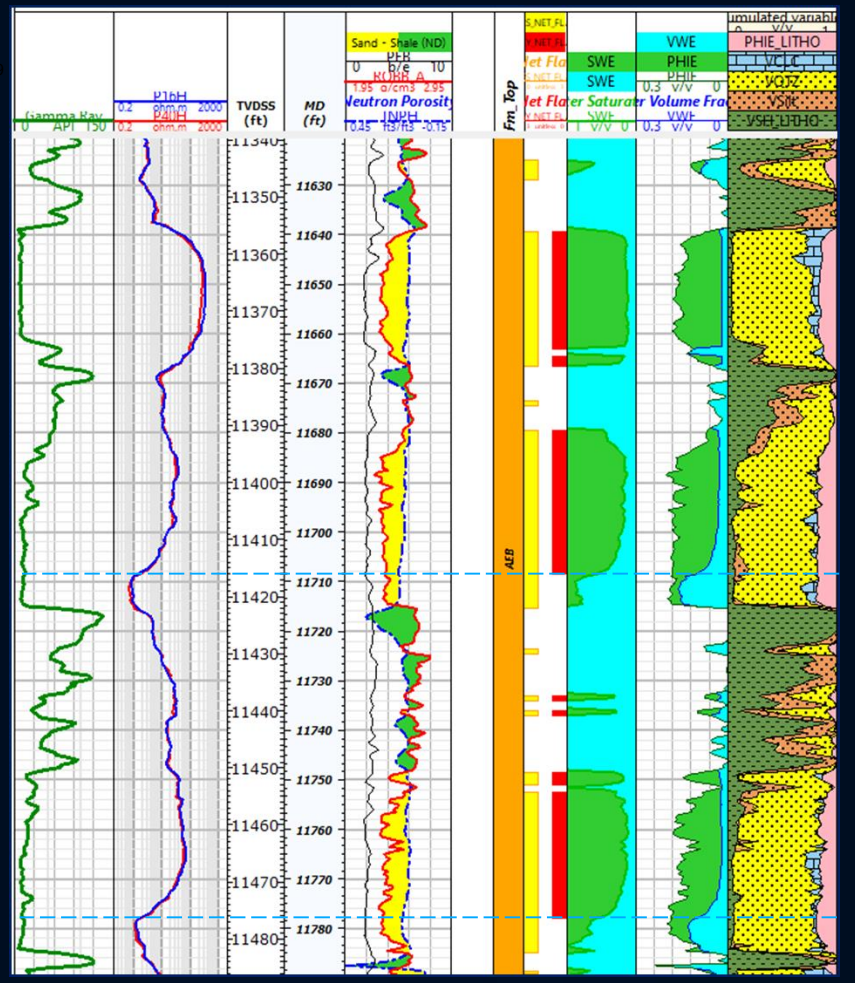
Hydrocarbon column prediction



Shale gauge ratio along fault plane

Watania 80-2 AEB (Unit 2) Success Case



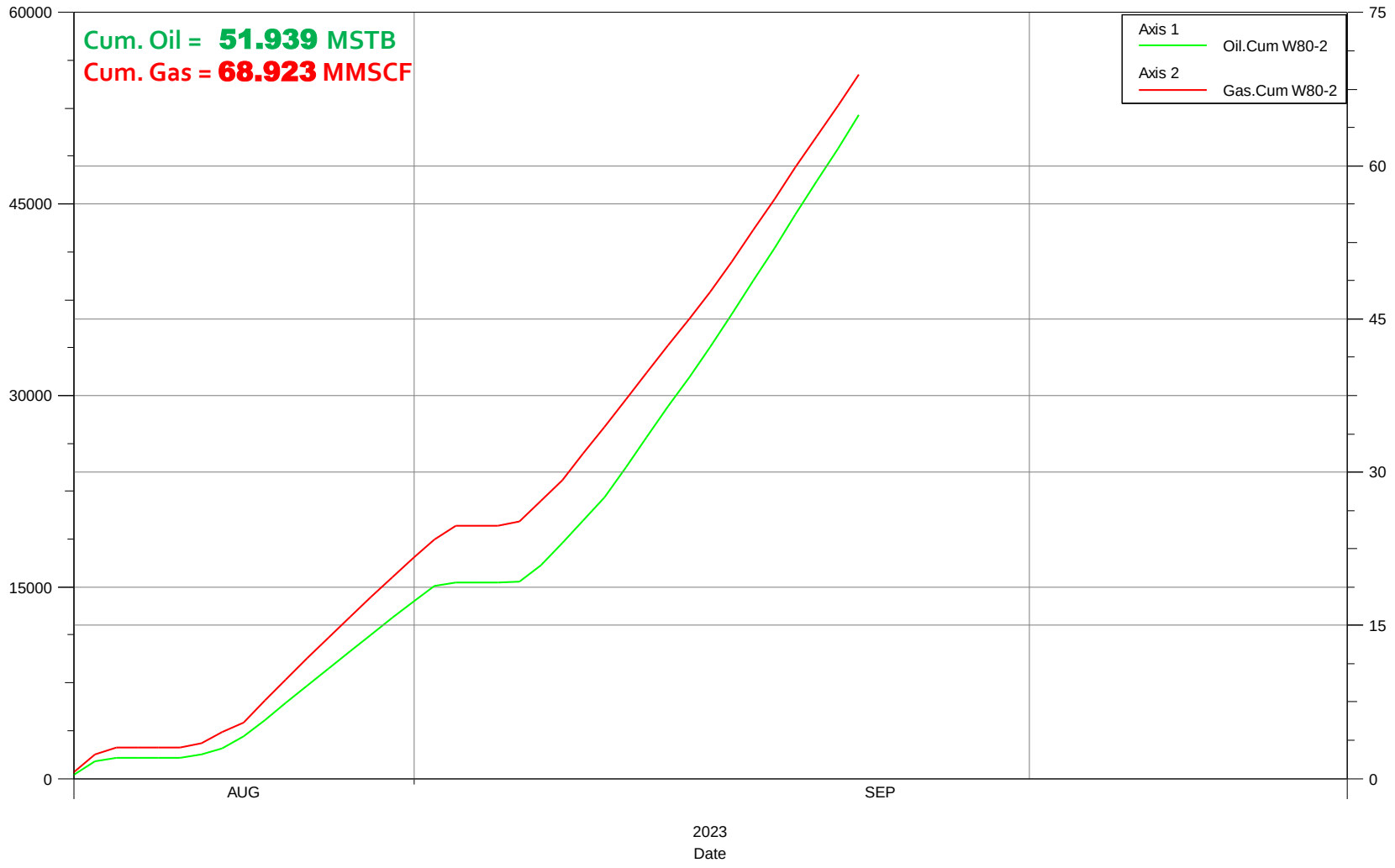


Net Pay : **86'**
Av. PHIE: **15%**
Av. SW: **19%**

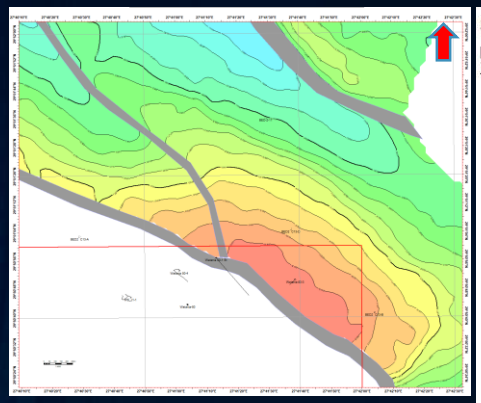
OWC-1 @ 11708.5' MD/ 11416' TVDSS

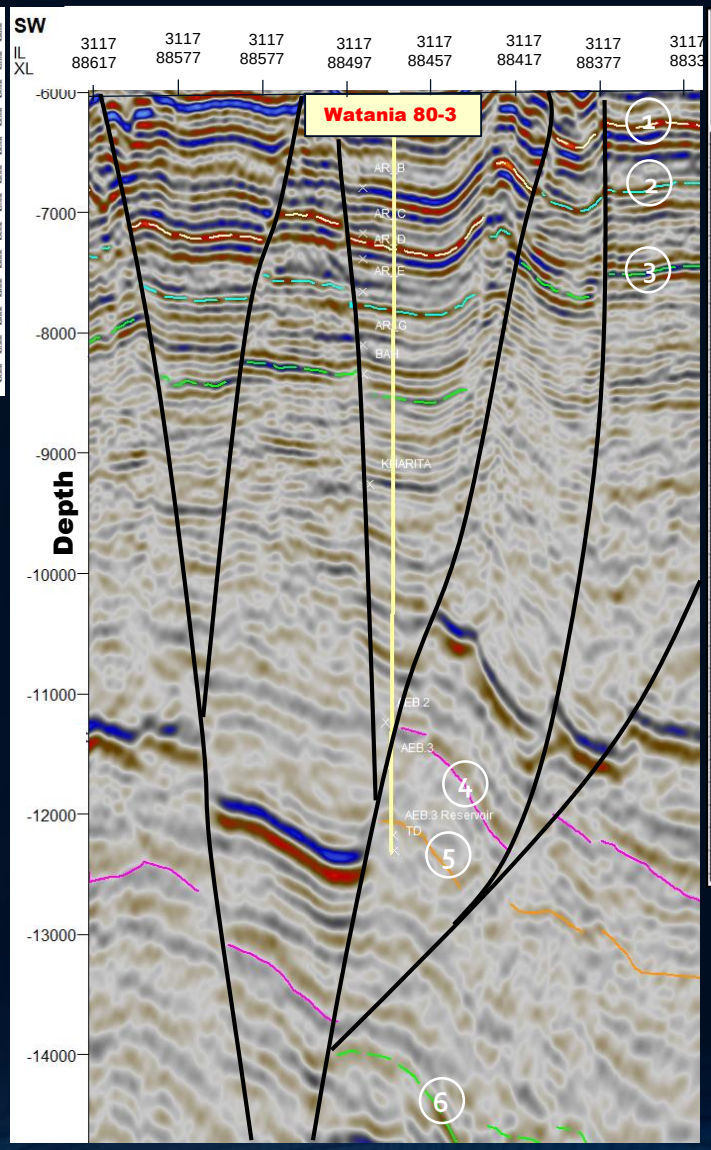
OWC-2 @ 11778' MD/ 11476' TVDSS

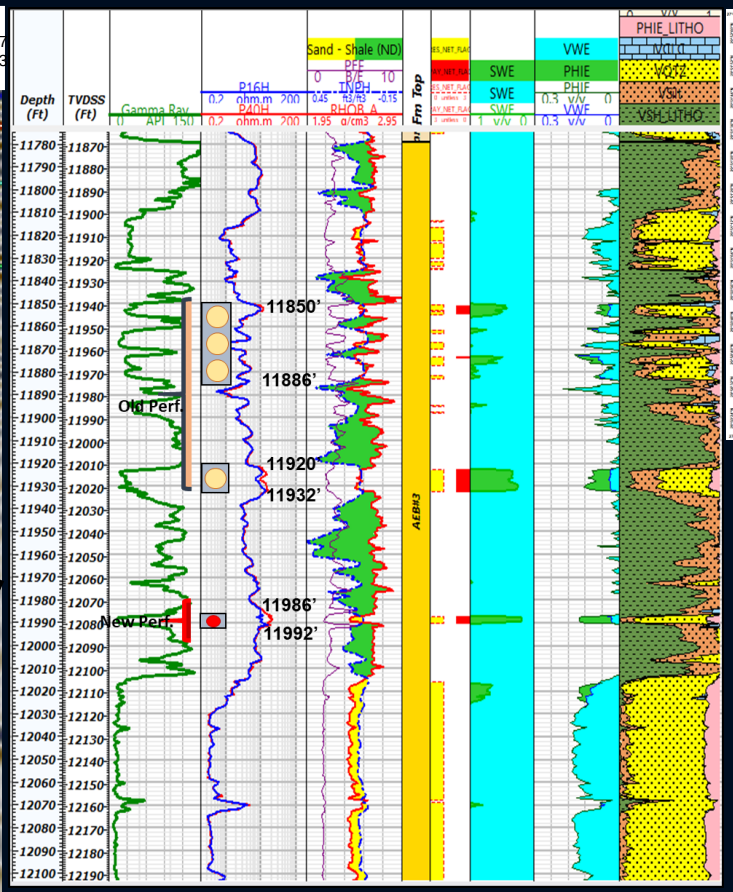
Watania 80-2 AEB (Unit 2) Production Chart

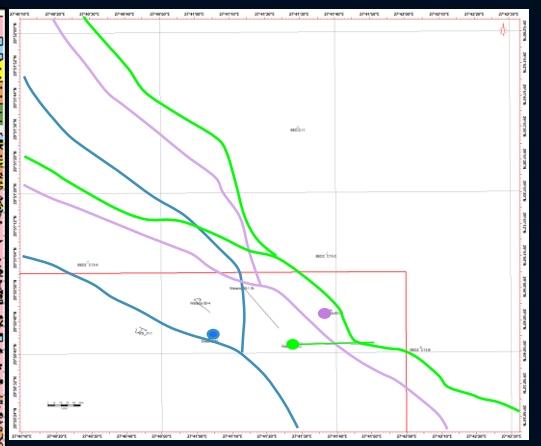


Watania 80-3 AEB (Unit 3) Success Case









AEB unit **2** Resr. well & polygon
AEB unit **3** Reser. well & polygon
AEB unit **5** Reser. well & polygon

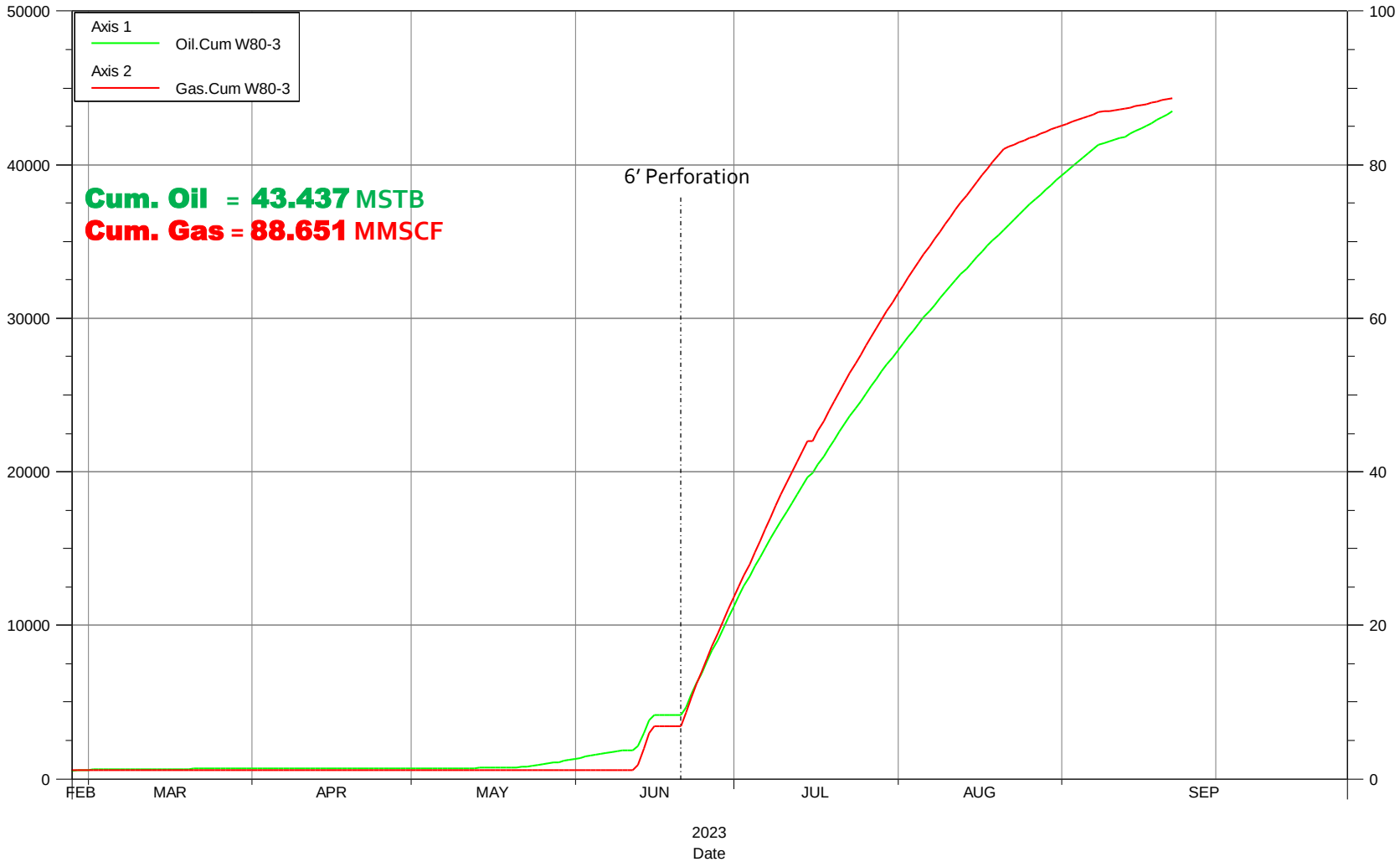
Net Pay : **16'**
Av. PHIE: **10%**
Av. SW: **32%**

1. ARC
2. ARE
3. Top Bahariya
4. AEB Unit **2** Reservoir
5. AEB Unit **3** Reservoir
6. AEB Unit **5** Reservoir

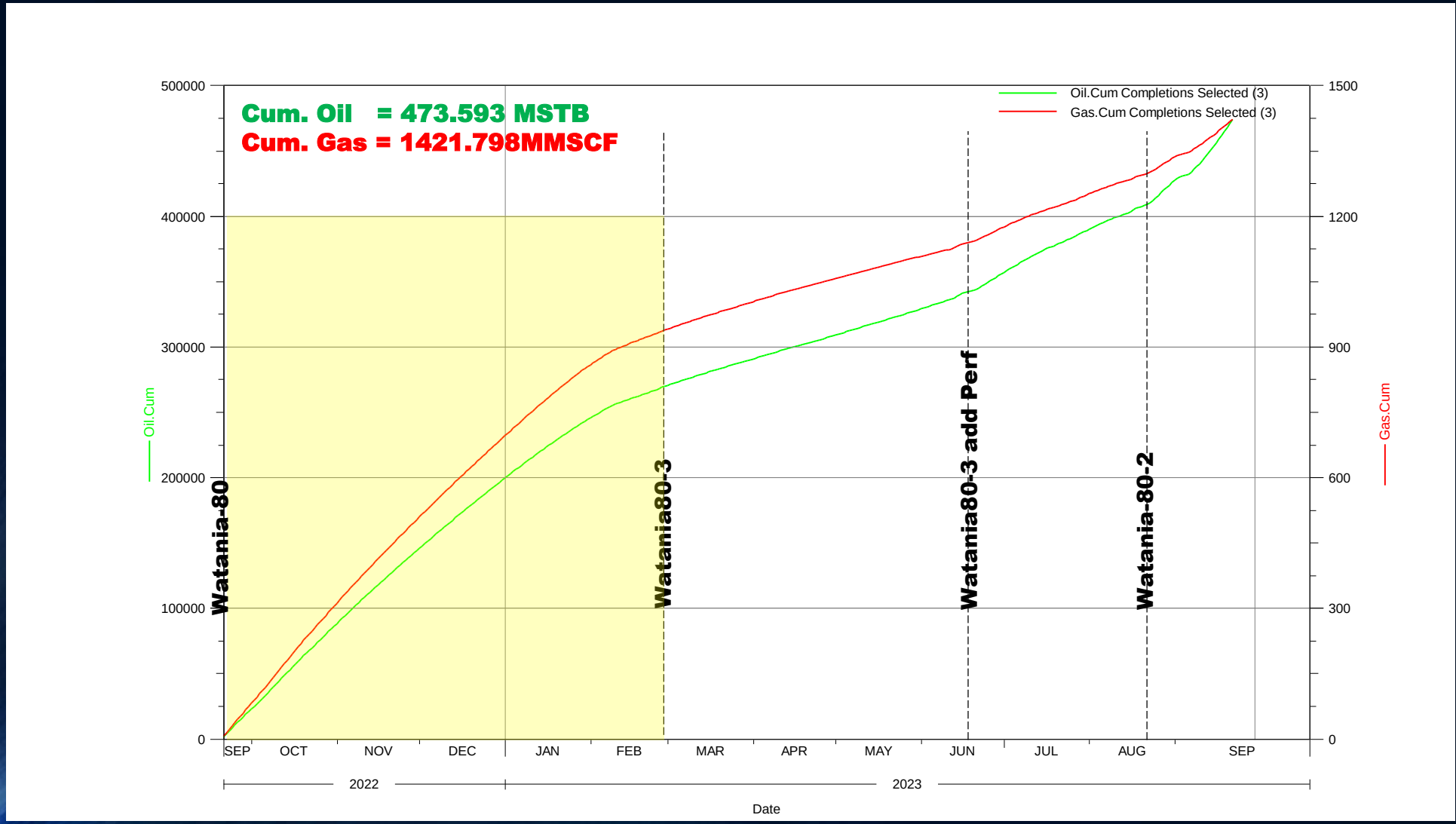
On 3-Mar 2023 Wattania 80-3 was tested for 4 days with using N2.
perforation (11850 ft-11886ft) 36ft & (11920 ft. – 11932 ft.) 12 ft. in AEB Formation:
AVG Oil Rate = 149 BBL/D
AVG BS&W%= 76%
NO GAS SHOW IN THE TEST

On 13 June 2023 the interval (11986'- 11992') MD 6ft was perforated the initial test results :
AVG Oil Rate = 1140 BBL/D
AVG BS&W%= 0 %
AVG Gas Rate = 2.3 MMSCF

Watania 80-3 AEB (Unit 3) Success Case

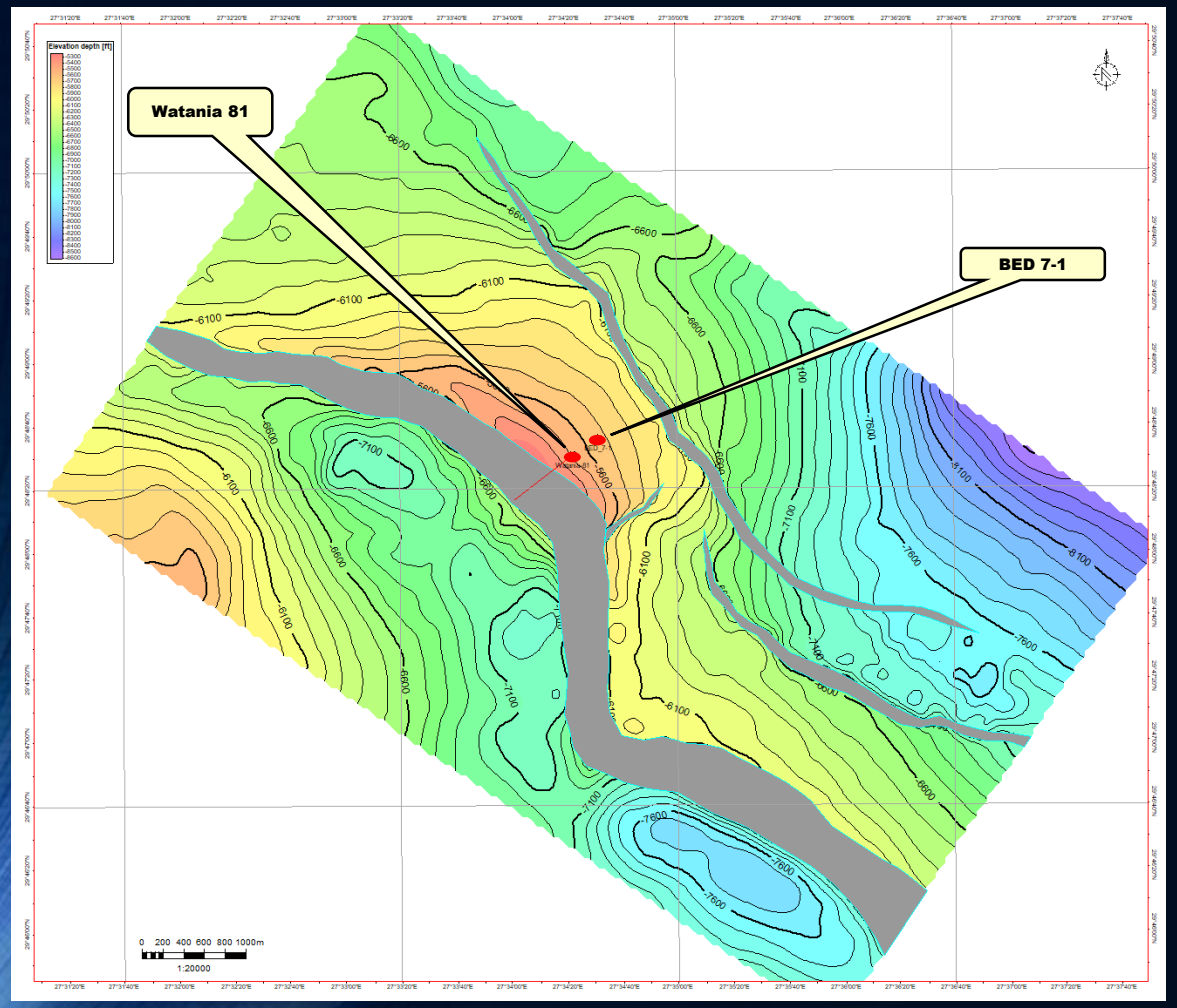


Alam El-Buieb Production Chart (Three Wells)



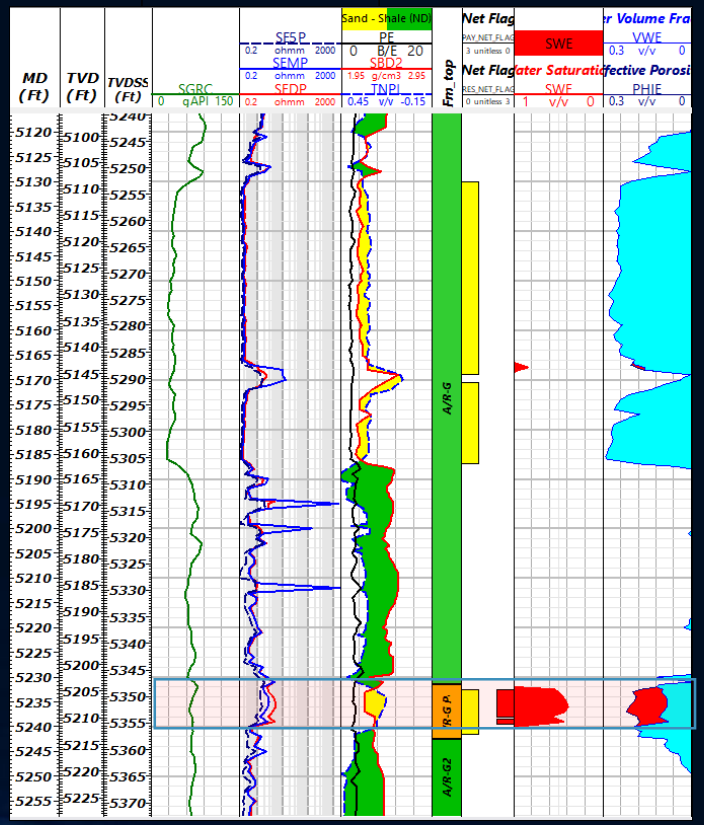
Abu Roash “C” Gas Discovery

Watania-81 & BED 7-1



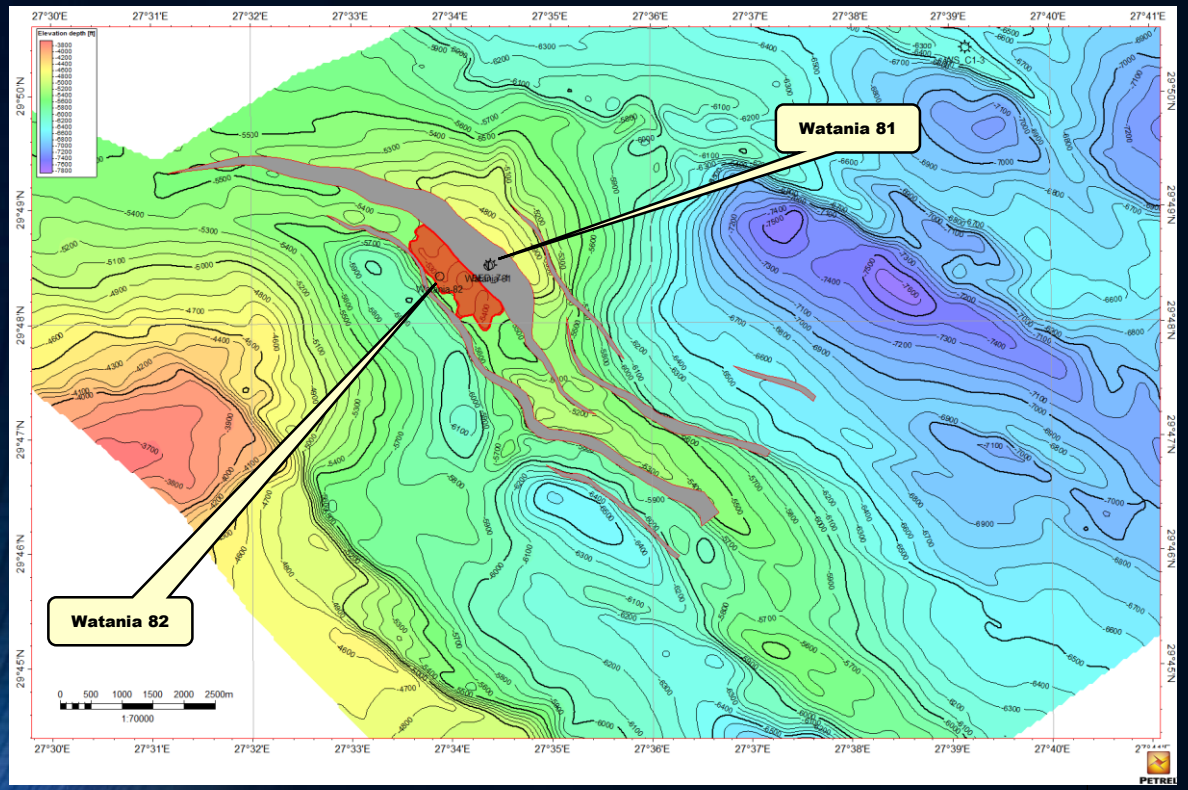
Top Bahariya Depth Map

- BED **7-1** drilled in **1985** on **2**D seismic data, Bottomed in Kharita fm.
- Watania- **81** drilled in **2022,** well bottomed in Alam El-Buieb (Unit 1)
- Neither both wells penetrated AR"C"
- Well confirmed Gas presence in AR"G" & Bahariya formations

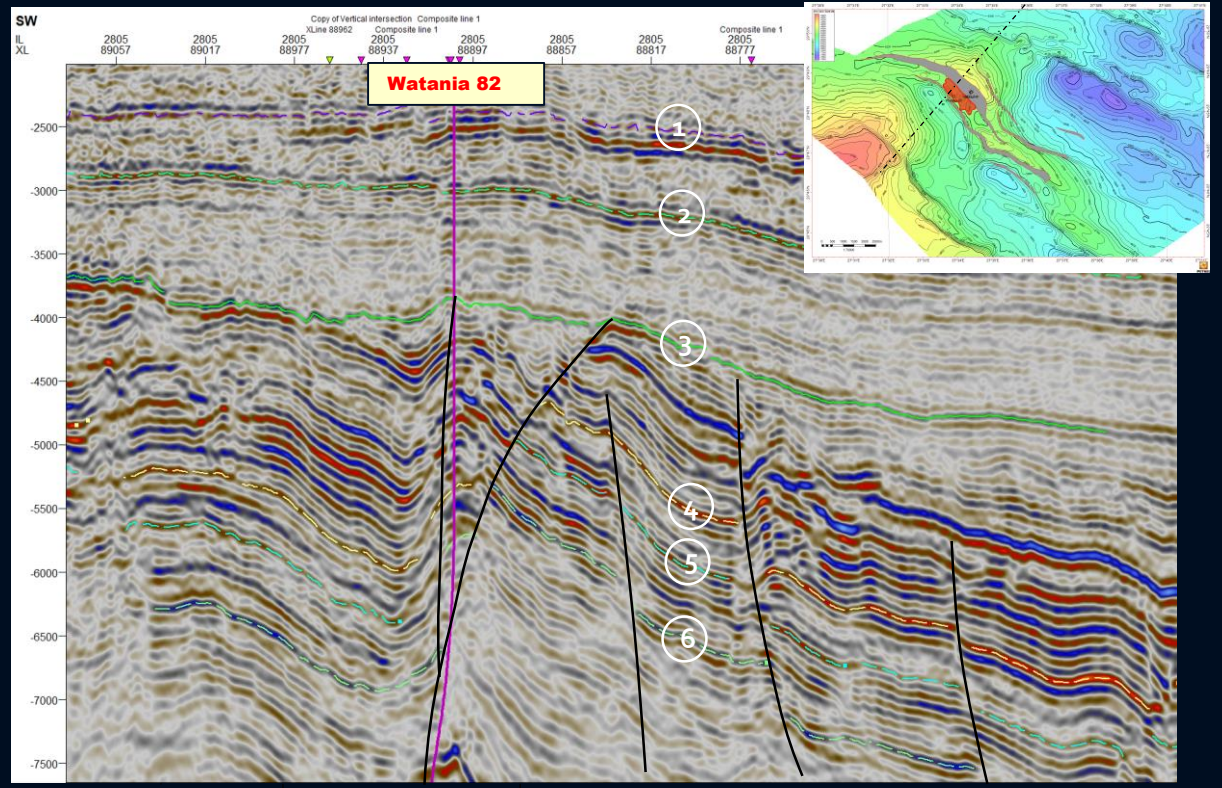


Net Pay : **9'**
Av. PHIE: **19%**
Av. SW: **42%**

Watania-82 AR”C” Gas Discovery

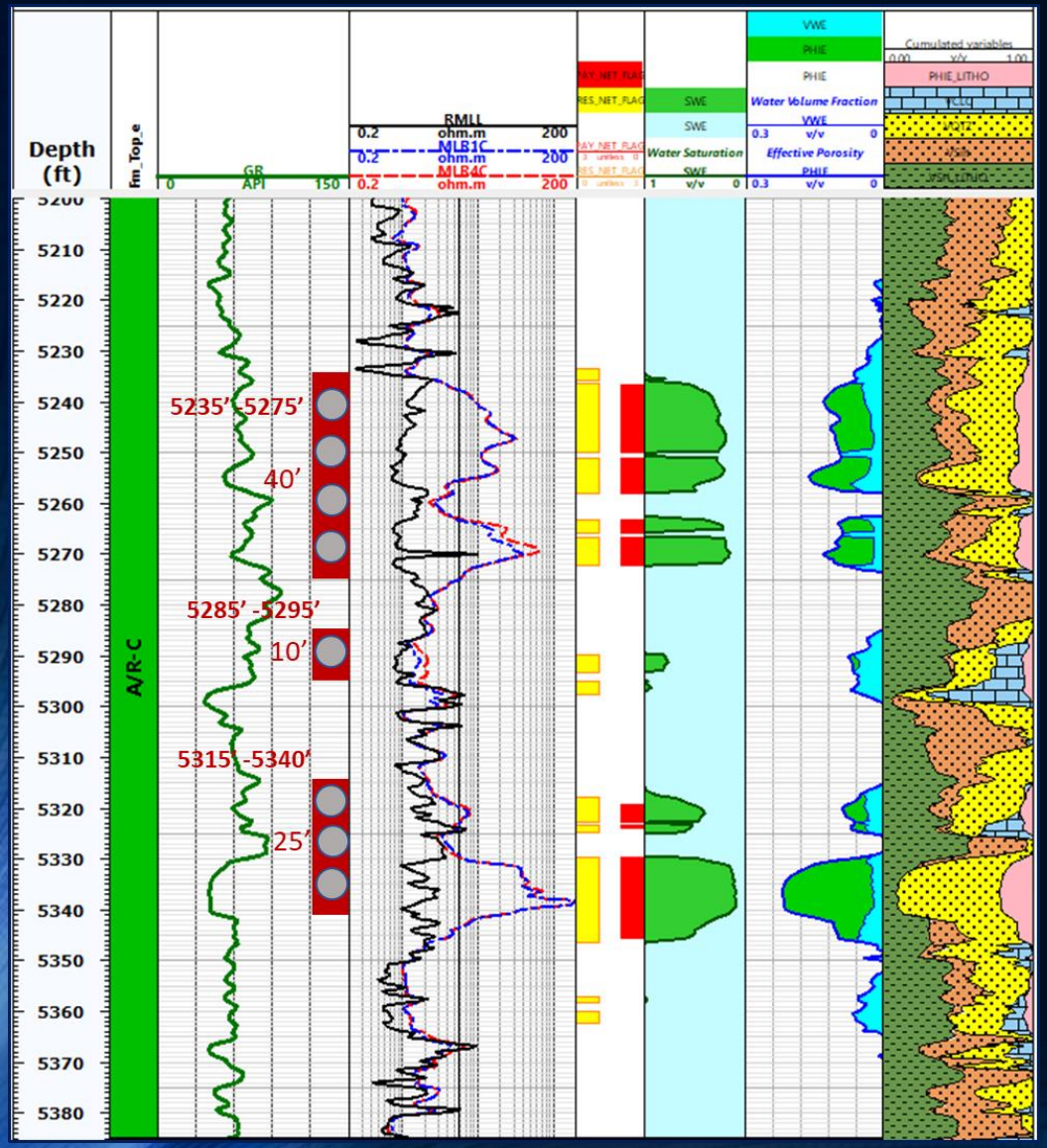


Top AR”C” Depth Map



1. Top Apollonia
2. Top Khoman
3. Base Khoman Unconformity
4. Top AR”C”
5. Top AR”E”
6. Top bahariya

Watania-82 AR”C” Gas Discovery Well Testing Results



- Net Pay 48 ft
- Av. PHIE: 13%
- SW : 25%

W82 Production Test Summary				
Choke size */64"	WHP Psi	Sep.Gas Rate MMcf/d	Sep.Cond. rate bbl/d	Sep.GOR cf/bbl
23	2100	5	113	38000
32	1980	9.4	282	32000
42	1820	15.3	290	54600

Area, acre	280
Thickness, ft	45
Phi, frac	0.13
Sw, frac	0.25
Bgi	0.0067
Eg	148

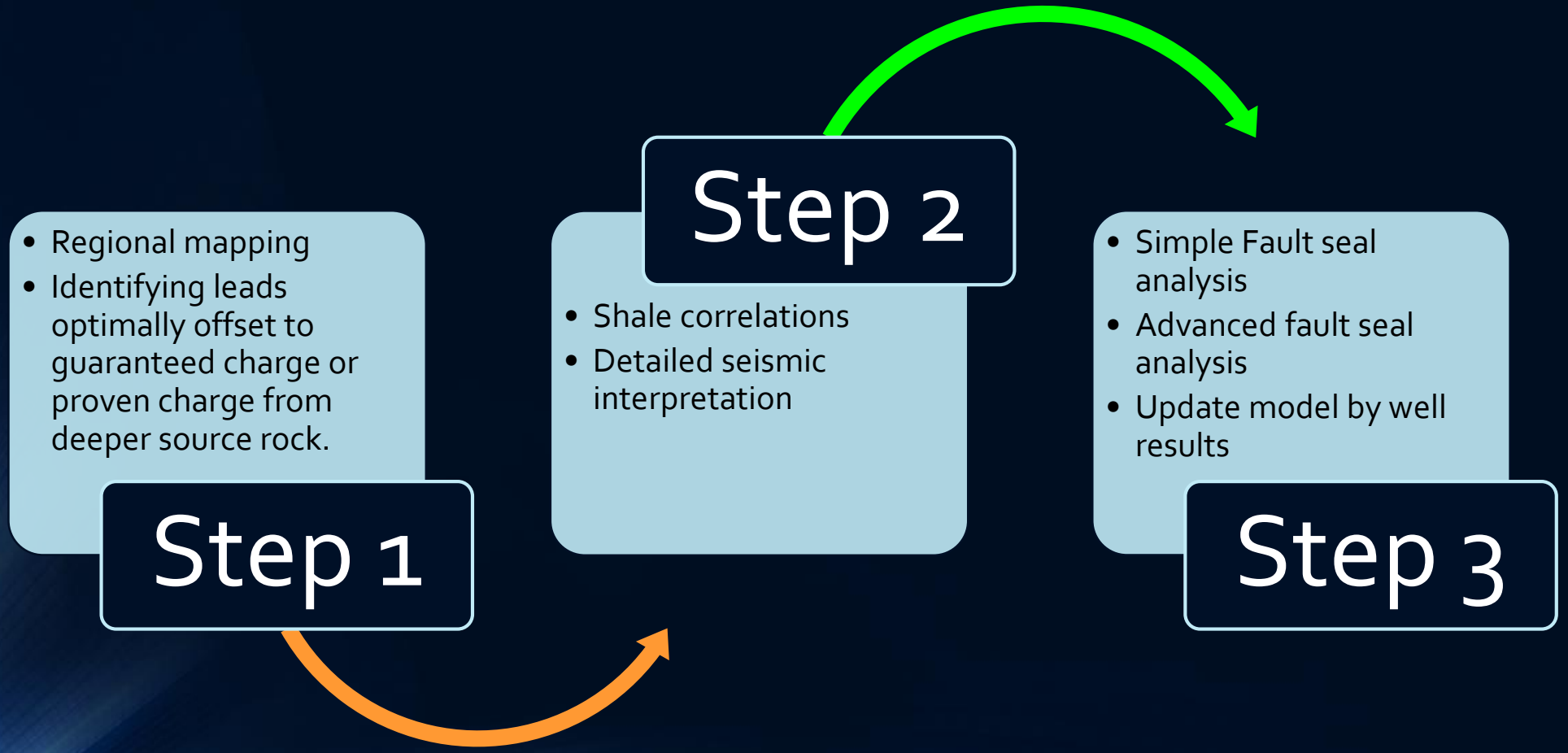
Volumetrics based on well test

GIIP BCF	CIIP MMSTB
8	0.072

Summary

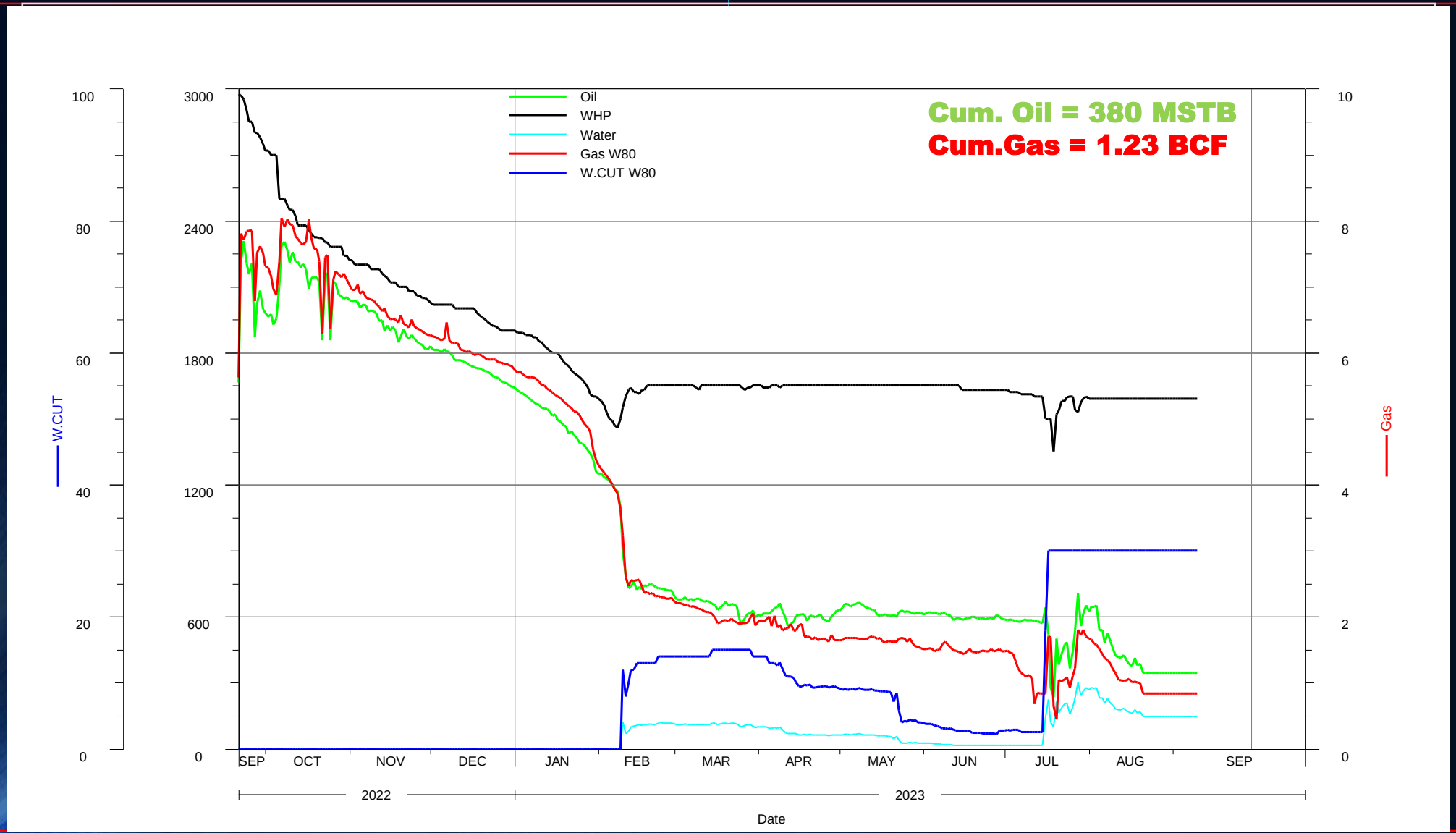
- Interpretation of correlatable shales is crucial for fault seal and success in AEB play.
- Reliable and calibrated fault seal analysis is a result of combining (good seismic data and detailed accurate seismic interpretation)
- Continuous success for AEB started last year by drilling first AEB unit **5** sands proving successful approach of unlocking AEB potentiality.
  - Successfully targeting other AEB sand units (**2** & **3**) applying same technique over same fault.
- Small pay sands in AEB might be of a great contribution to production (**6** ft producing **1500** BOPD)
- AEB sustainable success lifted production in the concession from **0- 5000** BOPD in one year (starting awarding)
- Cumulative production of **0.5** MSTB of oil & **0.15** BCF gas of three different units in AEB by three wells.
- Abu Roach "C" gas discovery highly promoted concept of the charge along faults (Deep seated faults).
- Abu Roach "C" gas discovery encouraged pursuing down thrown side structures related to discoveries or deep seated faults with access to source rock beneath it.
- Drilling parameters optimization helped to reduce cost of a deep wells down to **14,000** ft to be around **3** mm USD compared to offset well of same depth cost of **9** mm USD drilled in same structure by other operators.

Thank You


Step 1
Regional mapping
Identifying leads optimally offset to guaranteed charge or proven charge from deeper source rock.
Step 2
Shale correlations
Detailed seismic interpretation
Step 3
Simple Fault seal analysis
Advanced fault seal analysis
Update model by well results

Watania-80 AEB (Unit 5) Production Chart

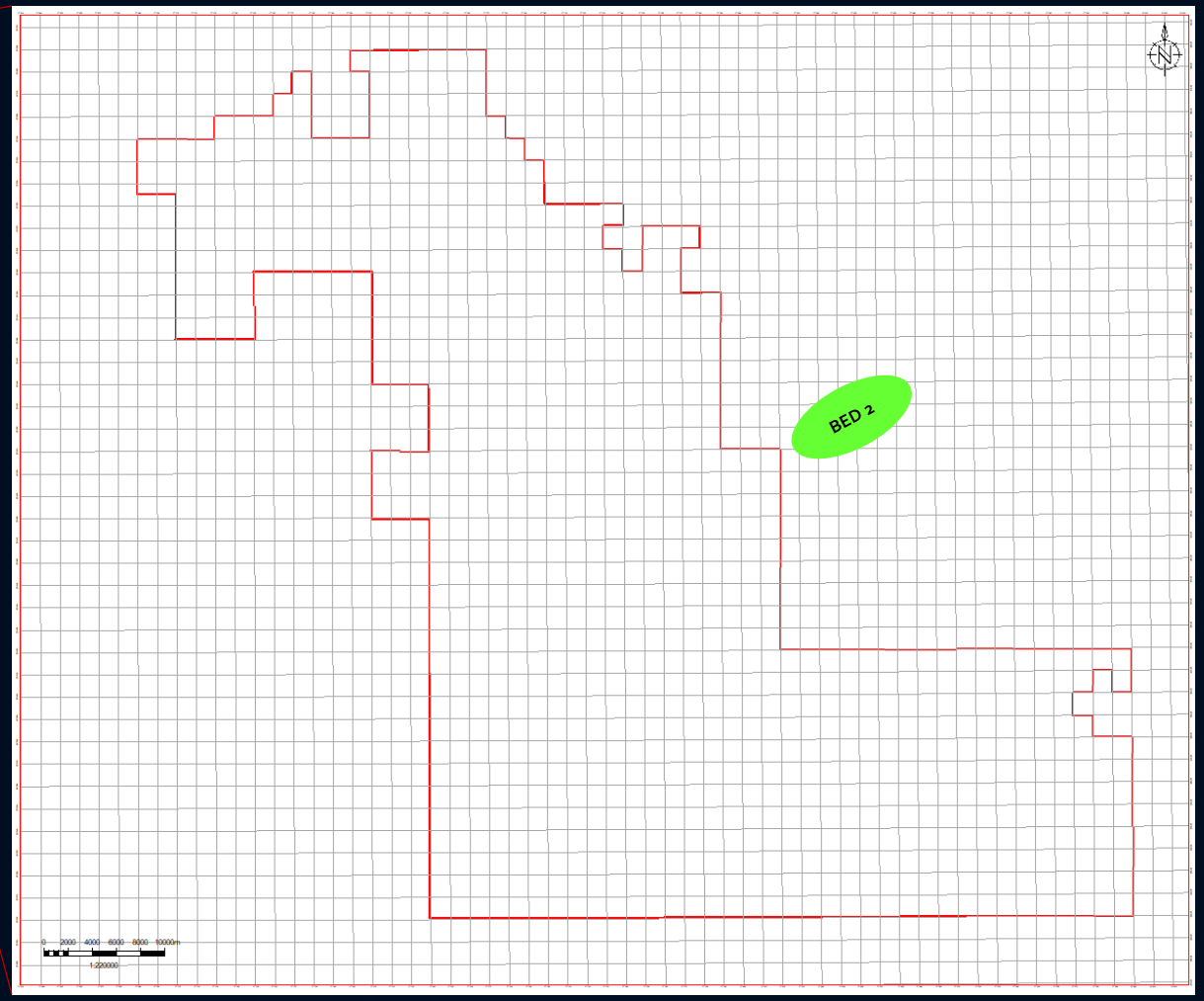
- Discover



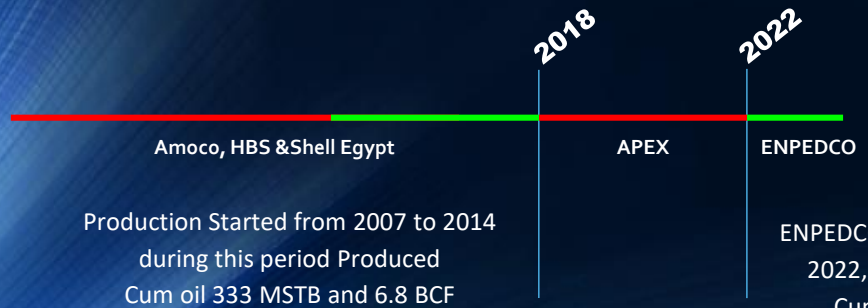
Concession Location & History

- Concession Located in Western Desert.
- Concession is situated to the West of Abu El-Gharadig Basin
- Concession is almost **2700** Km²
- Concession operated by several operators latest were SHELL EGYPT & APEX int.
- Production was established in the concession by former operators
- Concession is surrounded by mature producing fields of BAPETCO
- Surrounding fields producing Oil & gas (Gas facilities existing nearby BED 2)
- **24** wells drilled in the concession, recent **3** wells drilled by the latest operator last well prior ENPEDCO, drilled in **2020**
- Concession was awarded to ENPEDCO by December **2022** though first commercial discovery made by ENPEDCO on June **2022**

Concession Loc. Map



Concession Boundaries



Production Started from 2007 to 2014
during this period Produced
Cum oil 333 MSTB and 6.8 BCF

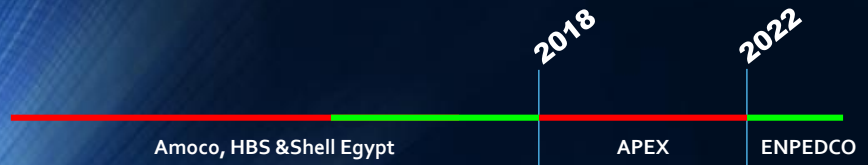
ENPEDCO started production September 2022, till now produced in one year
Cum oil 473 MSTB and 1.4 BCF

Concession Location & History

- Concession Located in Western Desert.
- Concession is situated to the West of Abu El-Gharadig Basin
- Concession operated by several operators latest were SHELL EGYPT & APEX int.

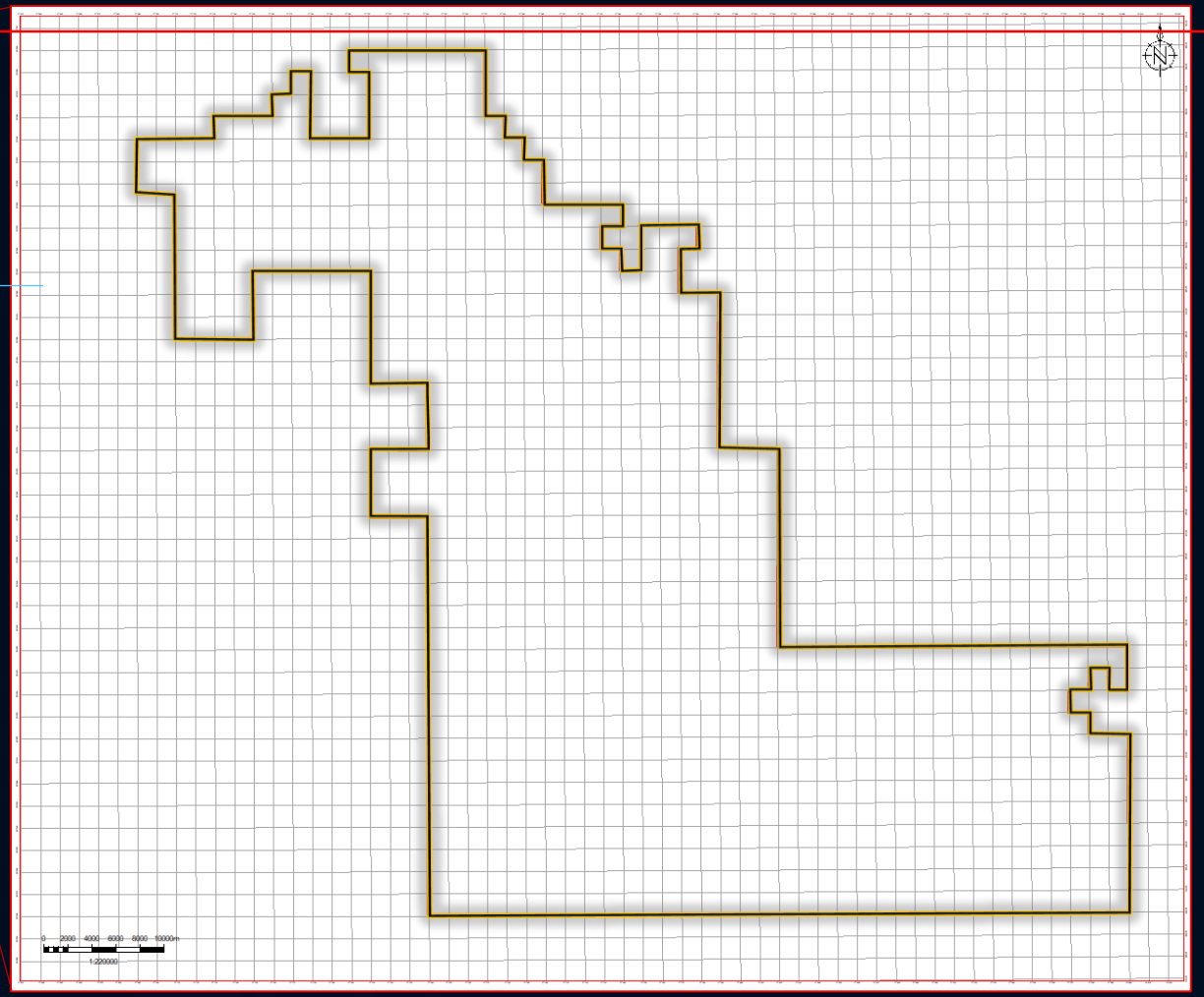
Concession Loc. Map

- Concession is almost **2700** Km²
- Production was formerly established in the concession
- Concession is surrounded by mature producing fields of BAPETCO
- Surrounding fields producing Oil & gas (Gas facilities existing nearby)
- **24** wells drilled in the concession, recent **3** wells drilled by the latest operator last well prior ENPEDCO, last well drilled in **2020**
- Concession was awarded to ENPEDCO by December **2022** though first commercial discovery made by ENPEDCO on June **2022**



Production Started from 2007 to 2014
during this period Produced
Cum oil 333 MSTB and 6.8 BCF

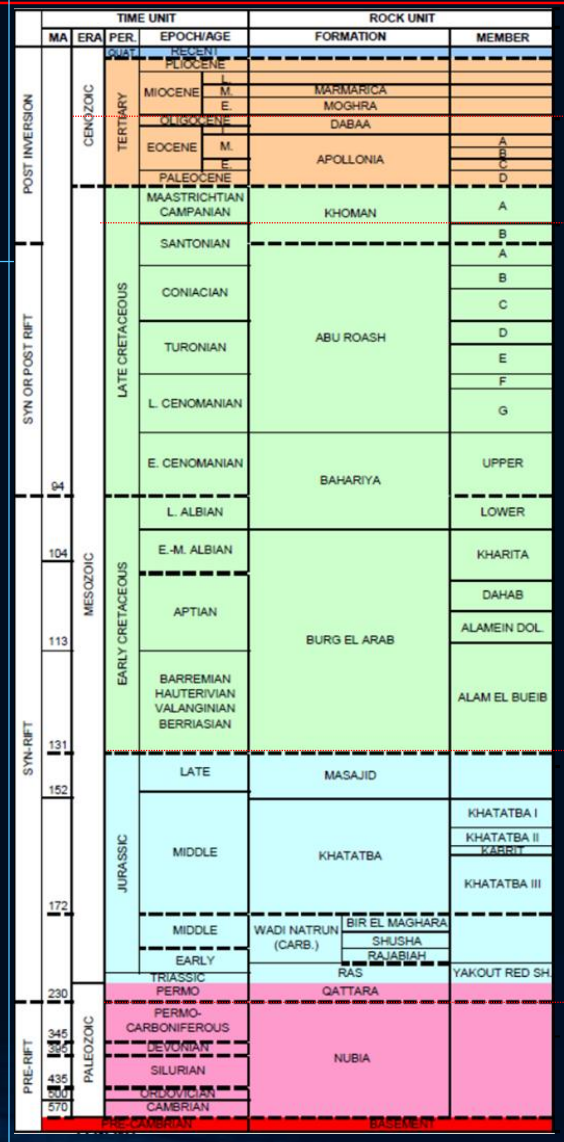
ENPEDCO started production September 2022, till now produced in one year
Cum oil 473 MSTB and 1.4 BCF



Concession Boundaries

Concession Regional Geology & Stratigraphic Column

- Discovered in **1969**, the Abu Gharadig (AG) Field was the first large hydrocarbon discovery in the Abu Gharadig Basin of the Western Desert of Egypt. Oil production began in **1973**, with gas brought into production in **1975**.
- The field produces mainly from upper Cretaceous clastic reservoirs.
- The AG Basin is an E-W trending intracratonic rift basin, about 330 km long and 50–75 km wide.
- It was initially formed as a large half graben basin during the Jurassic time in response to Tethyan rifting and continued to subside throughout the Cretaceous time.
- The half graben was subsequently inverted during the Late Cretaceous as part of the Syrian Arc deformation which affected northern Egypt.
- The Mid-Basin Arch, the AG Anticline, and the Mubarak High are three NE-SW oriented main inversion anticlines located within the AG Basin and are controlled by inversion of pre-existing Jurassic rift faults.
- The AG Anticline has an overall NE-SW orientation with a gentle plunge towards the NE and SW. It is locally bounded by two NE–SW-trending inverted faults on the southwest and northeast, accounting for the asymmetry of the anticline. Reverse offset of Cretaceous horizons is obvious at these inverted faults.
- Fault propagation folding is developed above the tips of the inverted faults at the Late Cretaceous Abu Roash and Khoman Formations
- inversion started during the Santonian time and continued into the Campanian-Maastrichtian. Inversion continued during deposition of the Paleocene–Middle Eocene Apollonia Formation and the Late Eocene–Oligocene Dabaa Formation



Post Dabaa Normal Faulting

Santonian Early Tertiary Basin Inversion

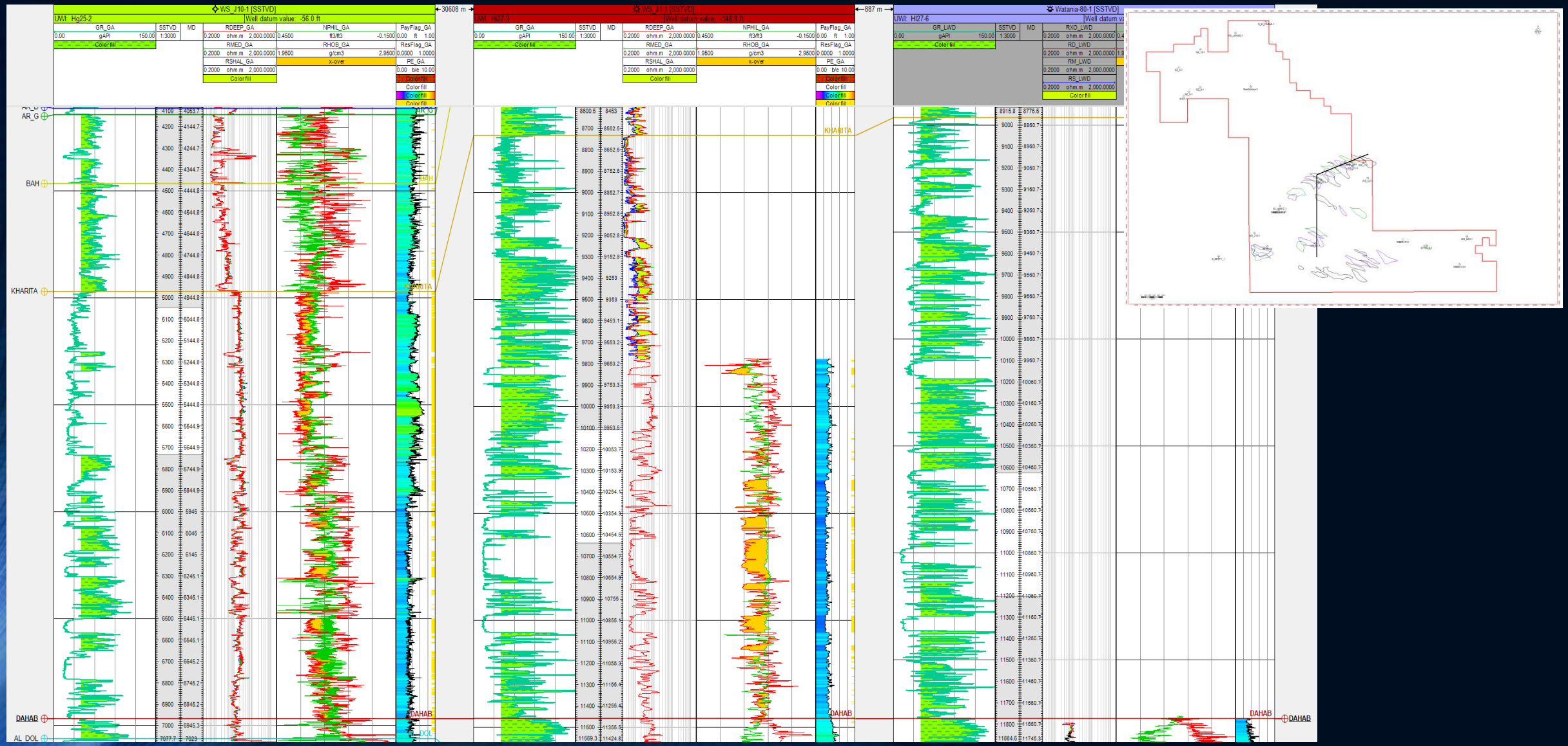
Rifting along WNW-ESE
- Up lift Qattara ridge & subsidence of AG basin
- Early Cretaceous AG opened

- Anti cline features formed and extensional rejuvenation of faults

Rifting along NE-SW
- Tethyan rifting
- Transisional E-W trending faults
- Faulting NW-SE
- E-W faulting

Initiation of AG basin

Kharita Shale Correlation



Add a Slide Title
- 4

Add a Slide Title - 5