

KHALDA PETROLEUM COMPANY



Apollonia Oil Discovery in Razzak Field, Alamein Basin, Western Desert, Egypt

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Designed & Prepared
Exploration Drafting

Why Apollonia in Razzak Field ??

1

Generally, searching about new sources for oil to increase production and reserves

2

After successful trial in JDT field (Apollonia Gas)

3

Good hydrocarbon indications from the available data like high gases and oil shows description in Apollonia Formation in some wells, especially in East and Main Razzak

4

Daily Production Decline in Razzak Field from 30844 BOPD in March, 2015 to 17000 BOPD August, 2017

Agenda

1

Location

2

Razzak Field History

3

Apollonia Formation

4

E.RAZZAK Case Study

5

Source Rock Evaluation

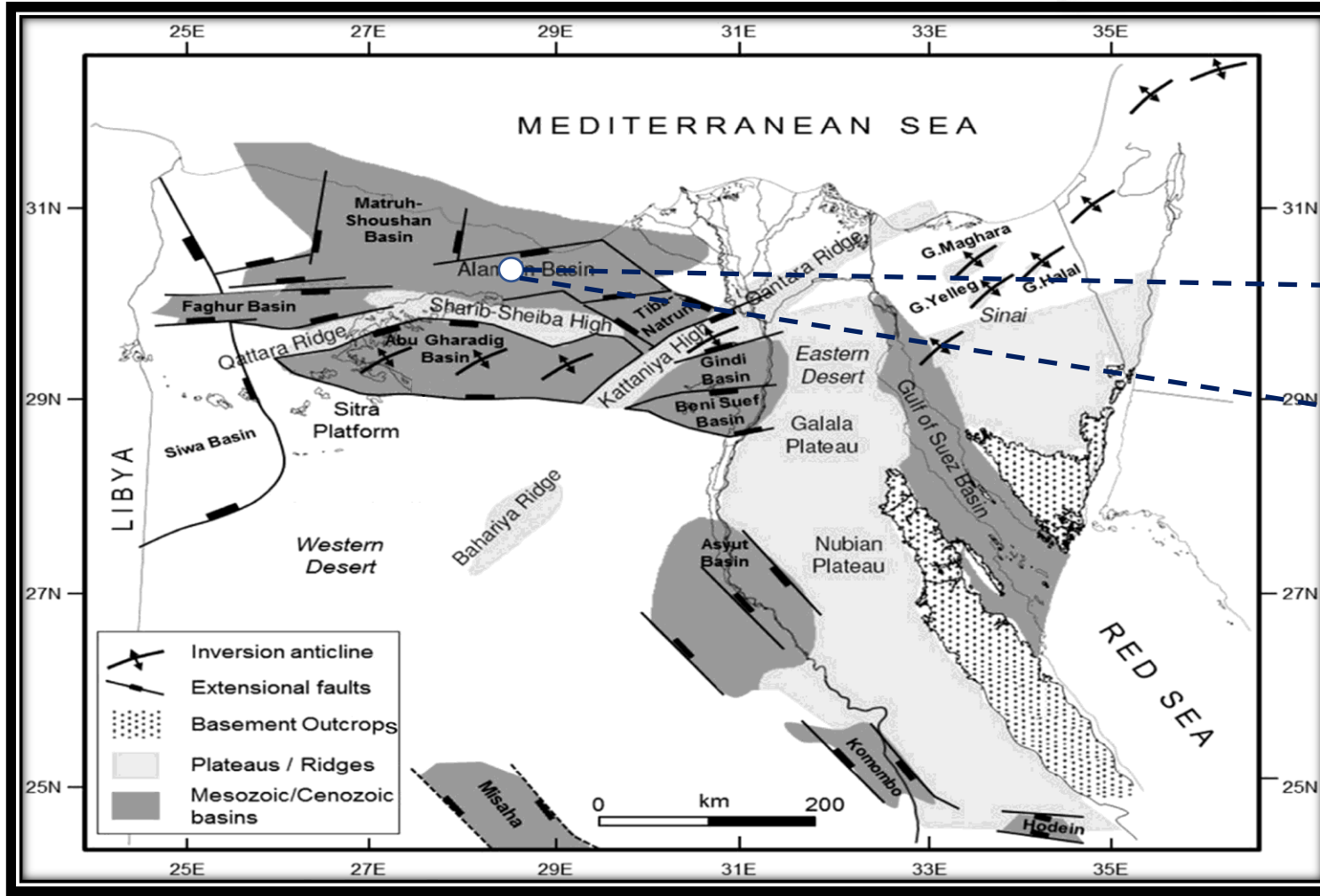
6

Oil – Source Correlation

7

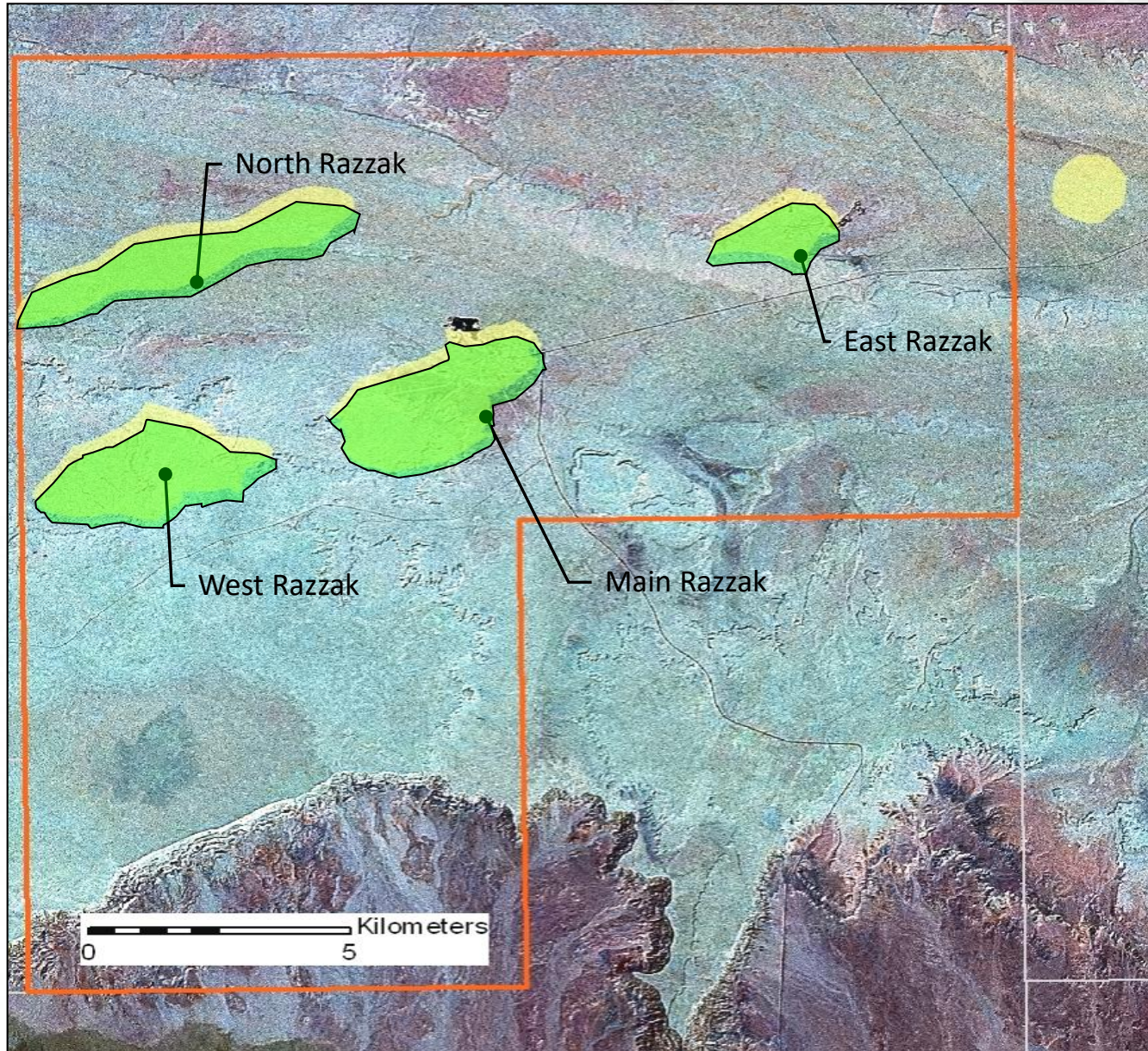
Recommendations

Location

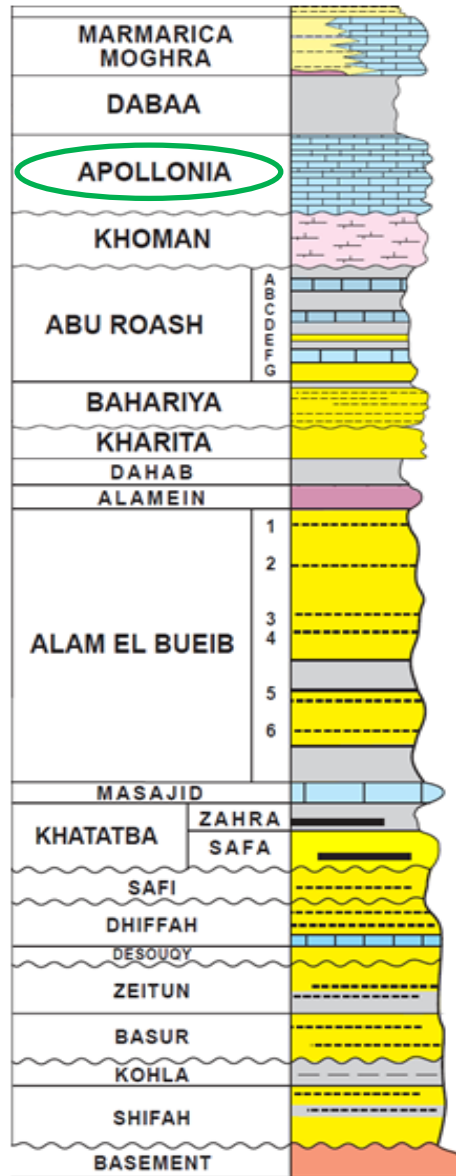


**RAZZAK
FIELD**

Razzak Field History



Apollonia Formation



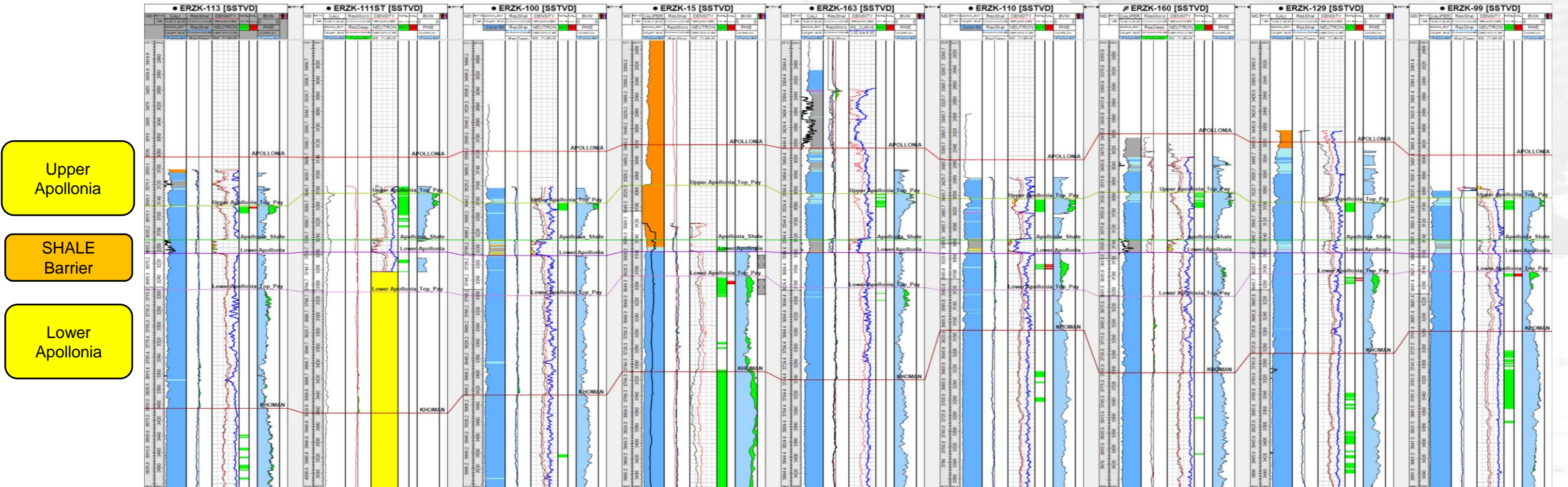
- Eocene Age

- Carbonate Reservoir (Mainly of LST)

- Deep Marine Environment

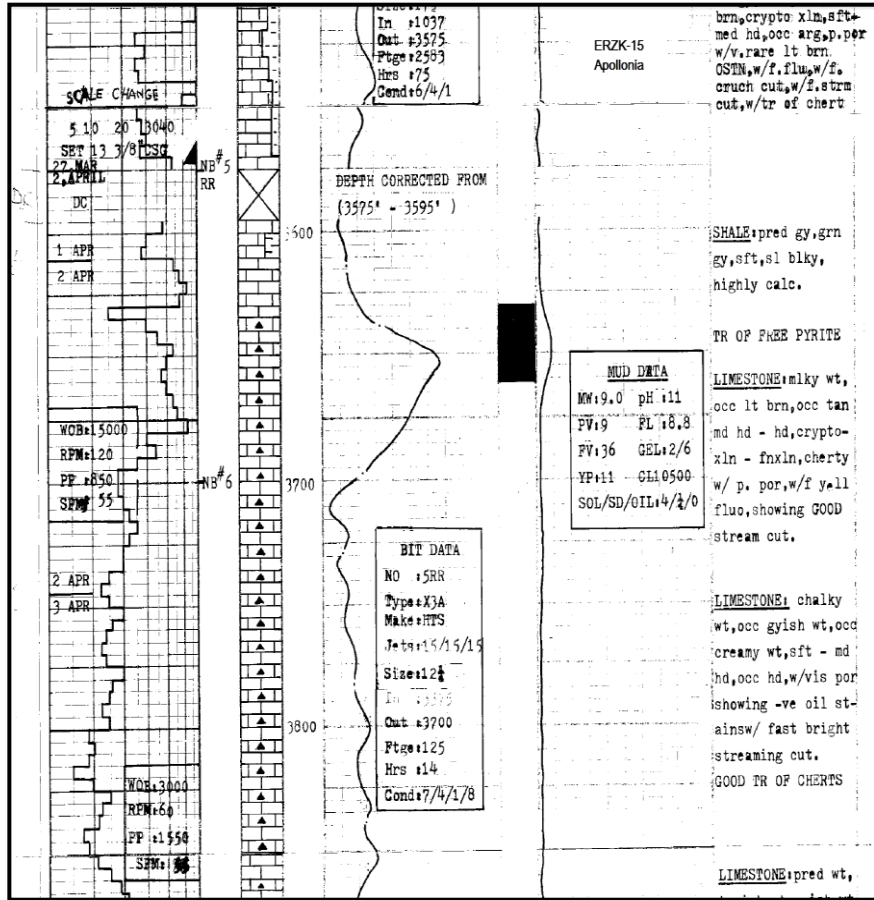
- Shallow in Depth (~3000 TVDss)

Apollonia Reservoir Distribution

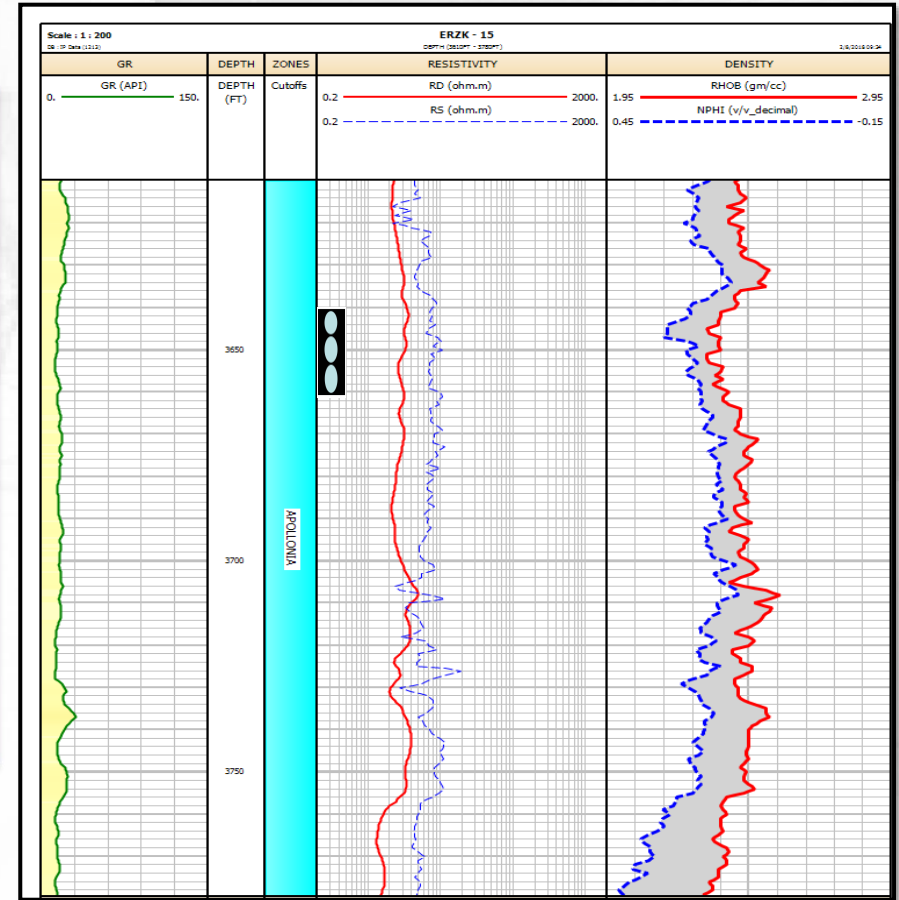


EAST RAZZAK CASE STUDY

ERZK - 15 (1st Trial)

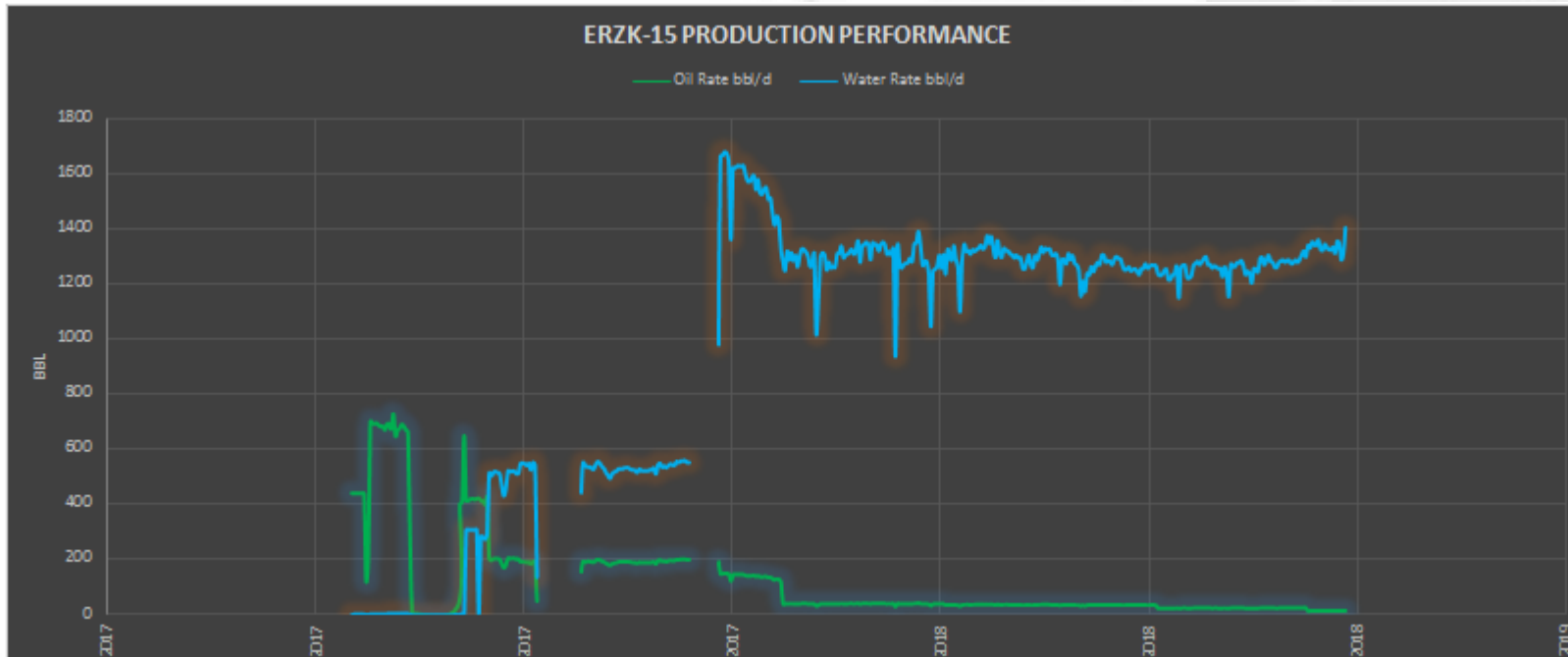


✓ Drilled 1978
 ✓ High Gases
 ✓ Oil Shows
 ✓ No CPI
 ✓ Reservoir
 Estimated Using
 Acid While
 Perforation
 (3640 – 3660) 20'



LST: Lt brn, occ tan, mod hd – hd, crypto- fnxln, cherty, w/ yell fluo, good stream cut.

ERZK – 15 (1ST Trial)

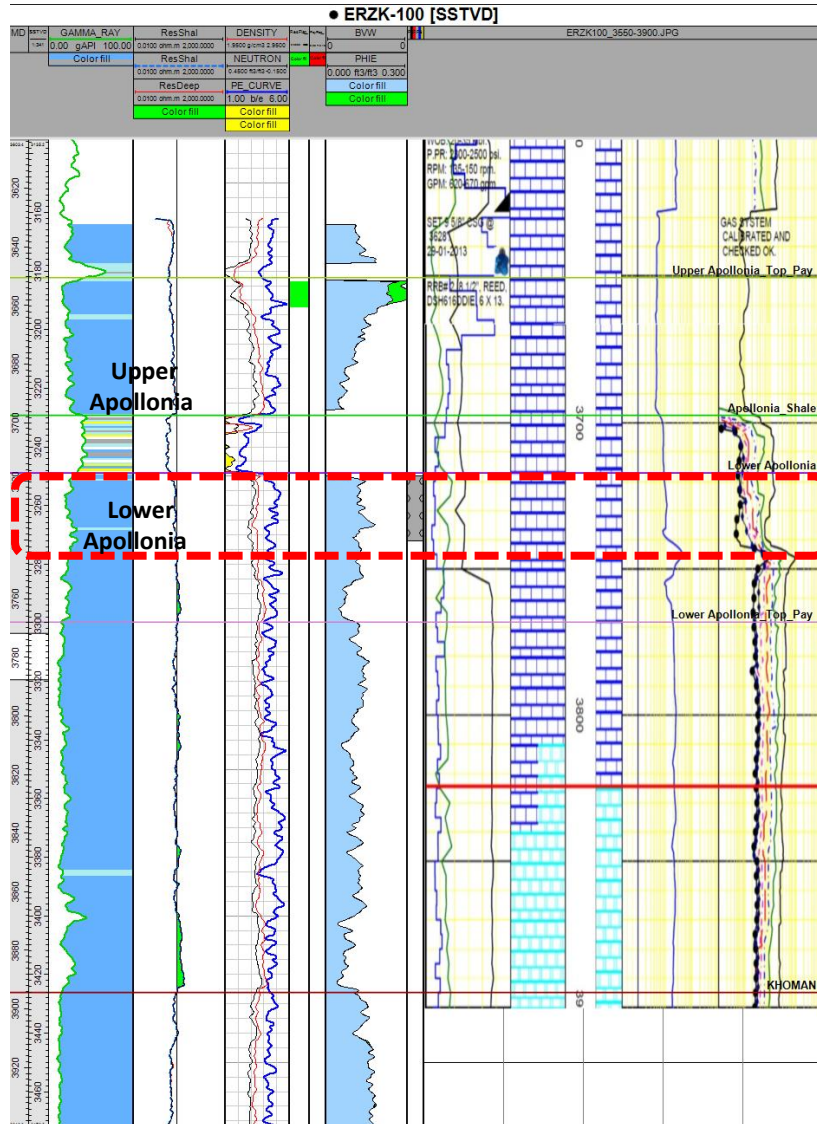


Formation	WHP	BFPD	WC	BOPD	API
Lower Apollonia	180	300	0.6	300	14

Cumm. Oil Production

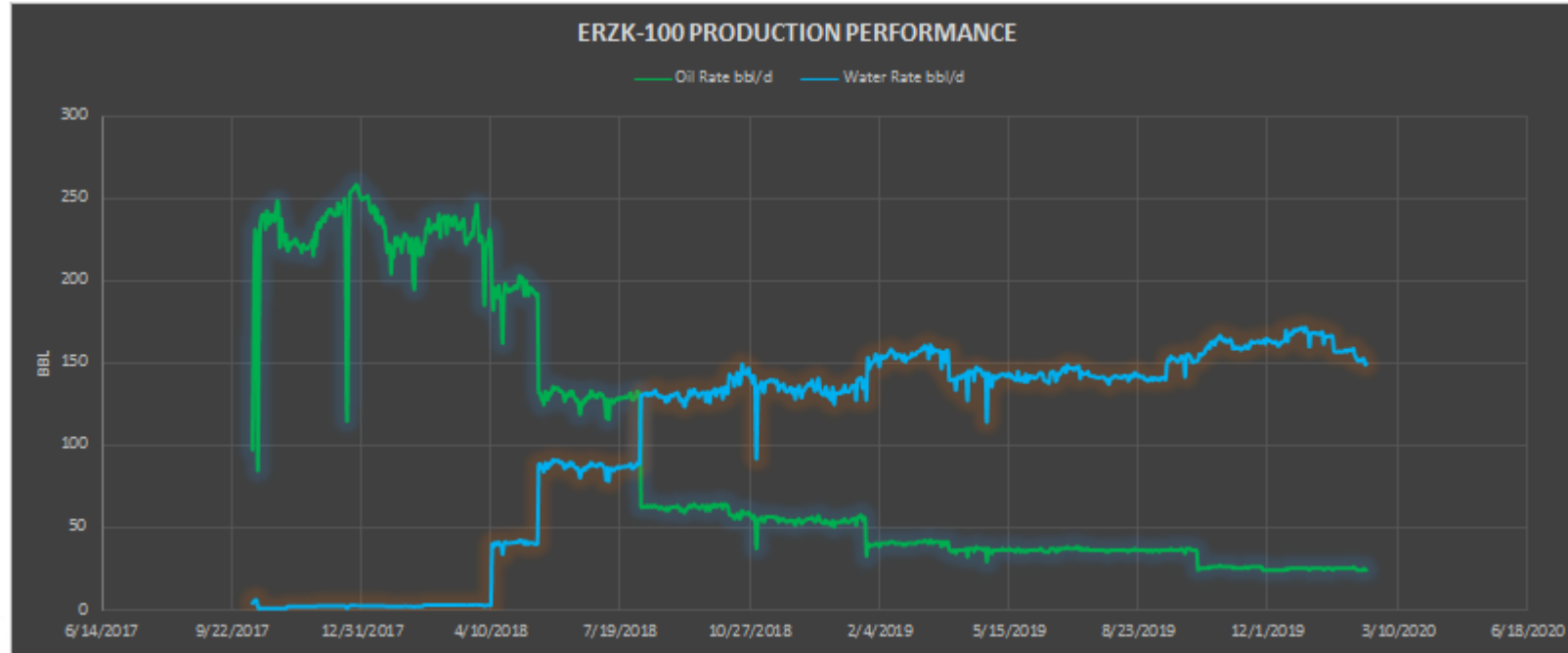
50 MSTB

ERZK – 100 (2nd Trial)



- ✓ Drilled Feb, 2013
- ✓ High Gases
- ✓ No Oil Shows Description
- ✓ No Petrophysical Evaluation
- ✓ Reservoir Estimated Using Acid While Perforation

ERZK – 100 (2nd Trial)



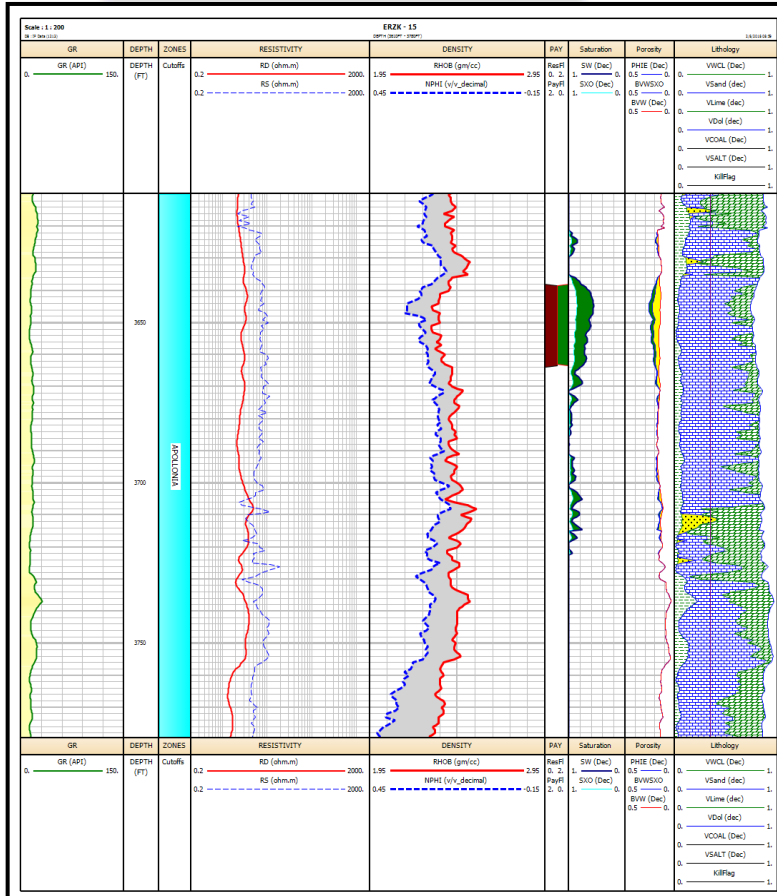
Formation	BFPD	WC	BOPD	API
Lower Apollonia	206	4	198	13.3

Cumm. Oil Production

83 MSTB

Re-evaluation for ERZK – 15 & 100

ERZK – 15



CUTOFF PARAMETERS

✓ R_w 0.065 ohmm @ 135° F

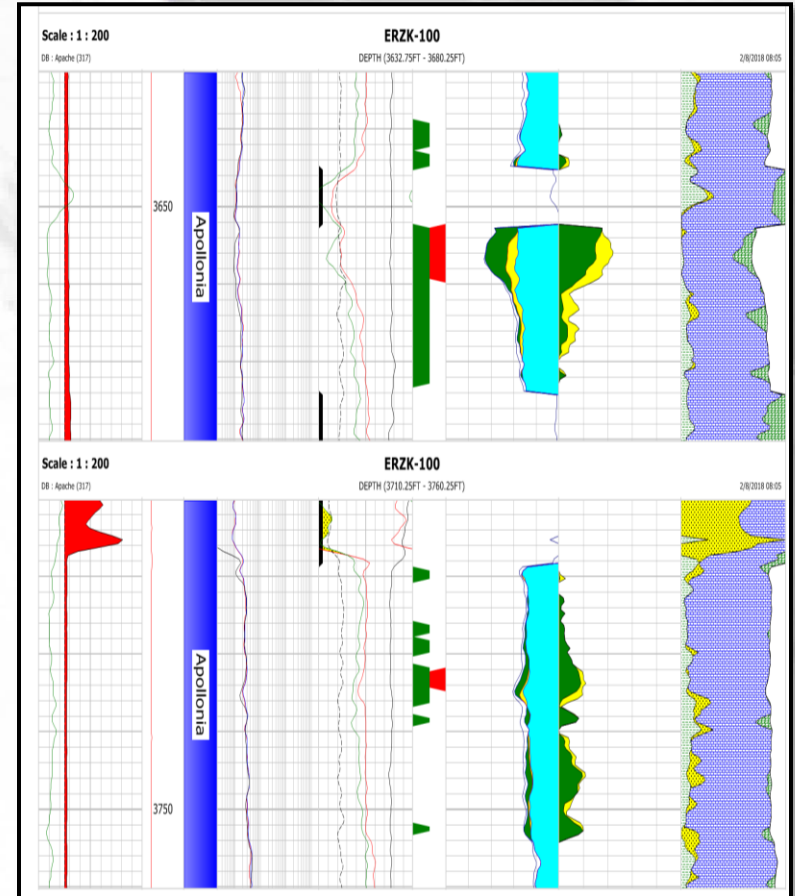
✓ Sw ----- 70 %

✓ Eff. Porosity ----- 15 %

✓ Clay Volume ----- 30 %

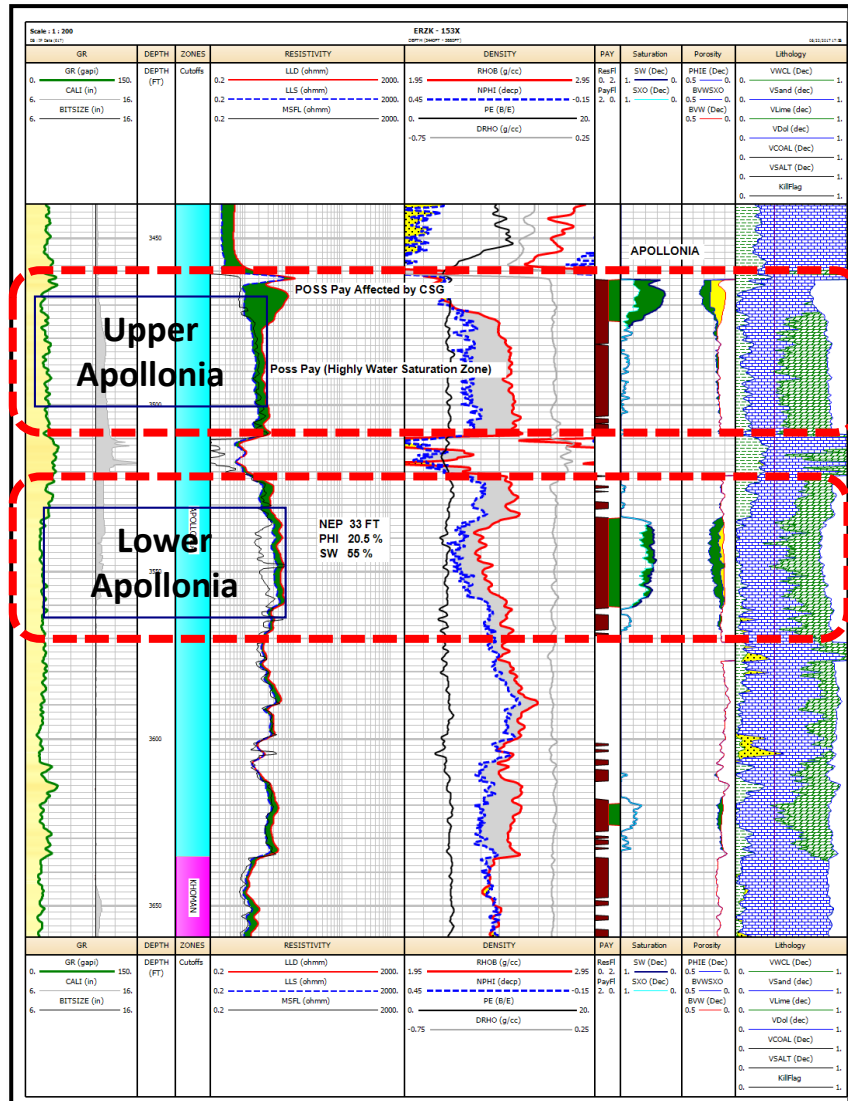
NE	Eff. Porosity	SW
P		
26'	23 %	65 %

ERZK – 100



NE	Eff. Porosity	SW
P		
10'	27 %	70 %

ERZK - 153x_ Reservoir Evaluation

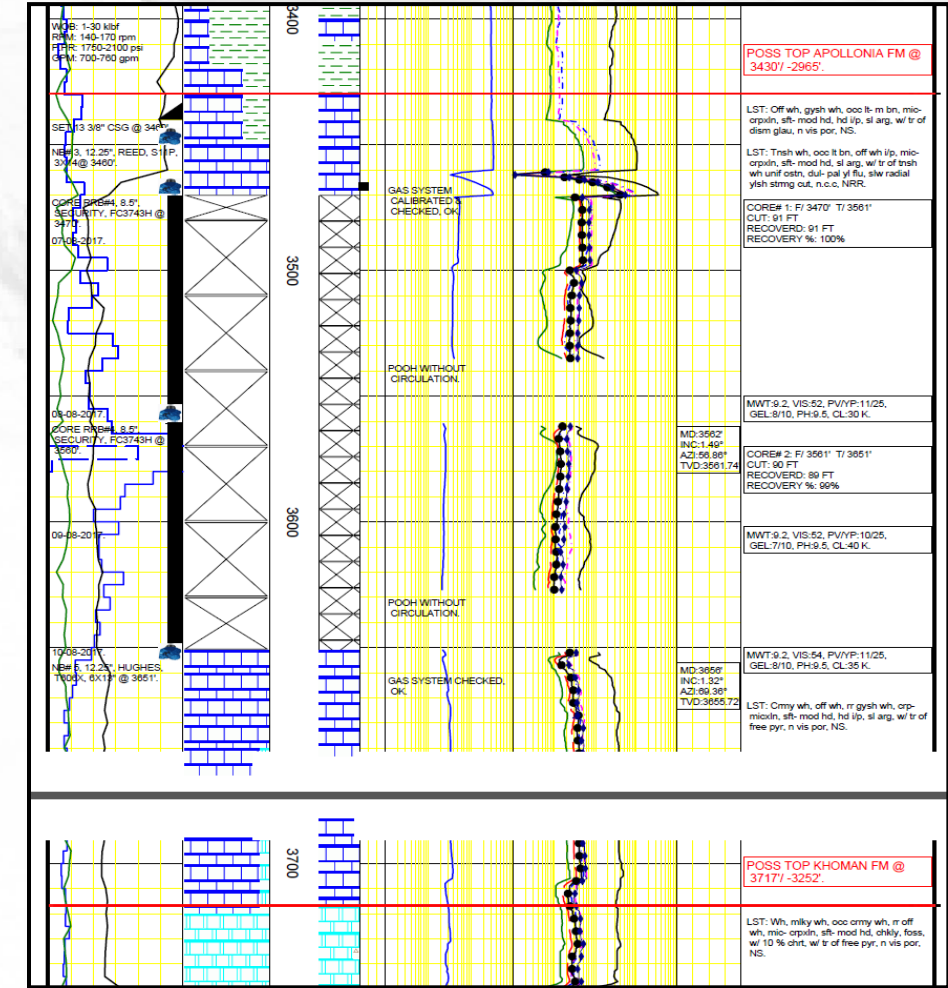


✓ High Gases

✓ Oil Shows

✓ Petrophysical Evaluation

NEP	Eff. Porosity	SW
33'	20.5 %	55 %



ERZK – 153x _ Lower Apollonia Reservoir

Geological Characterization

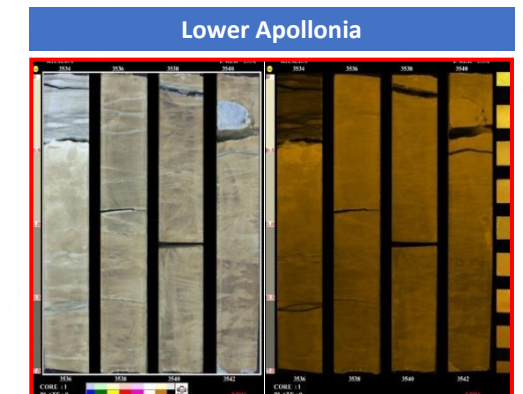
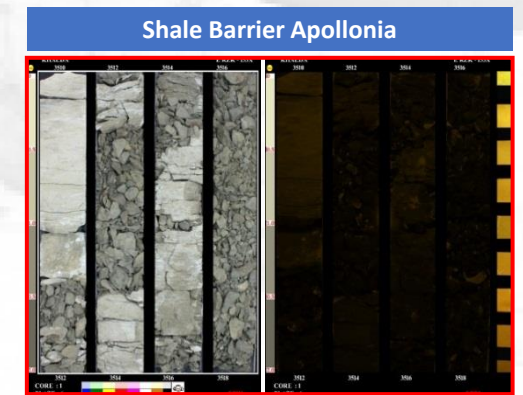
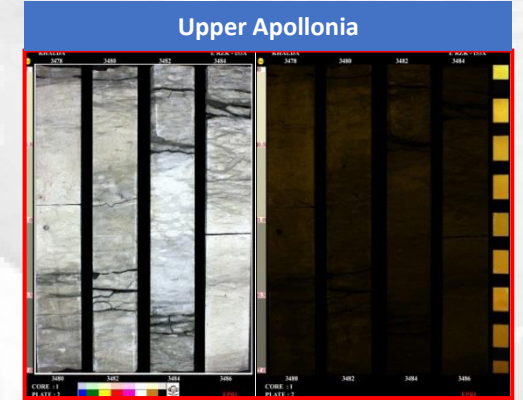
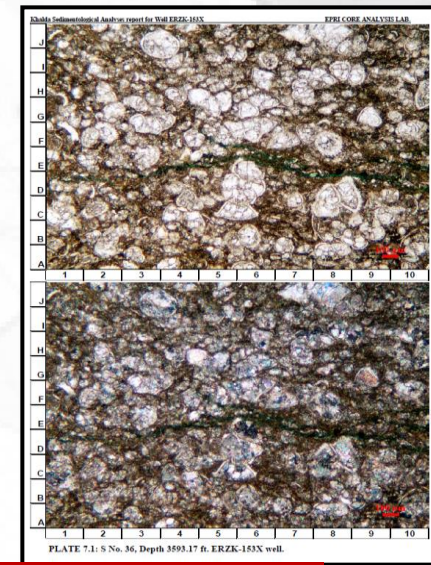
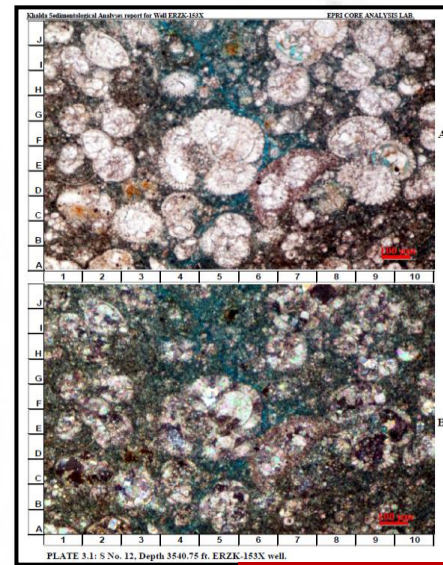
Conventional Logs

- Very high porosity with very low permeability.

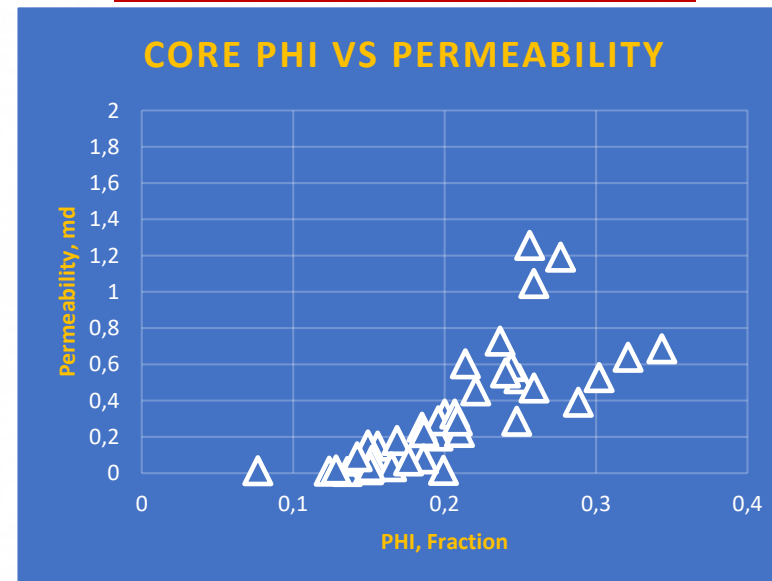
Core Description and Petrography

- Core analysis came very matched conventional results. The porosity described as matrix porosity type of value around 23 pu. and permeability up to 1 md.
- Preserved original rock fabric with limited influence of post-depositional processes and fractures.
- The rock is mainly described as **Packstone** against the sweet interval of Lower Apollonia Reservoir composed of small and large foraminifera with some micrite, disseminated pyrite and glauconite.

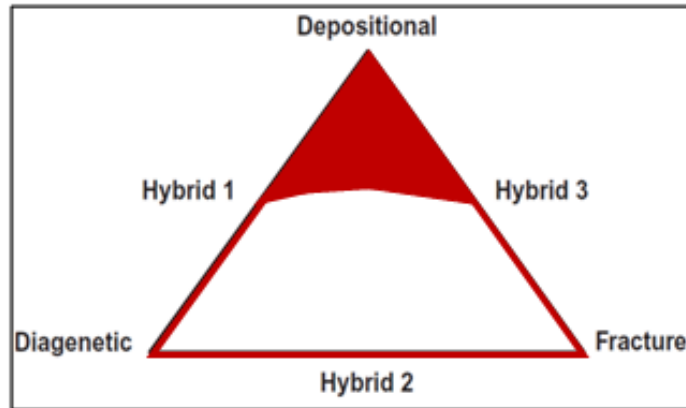
Geological Core Description and Petrography Analysis



Core Porosity vs Permeability



ERZK – 153x _ Lower Apollonia

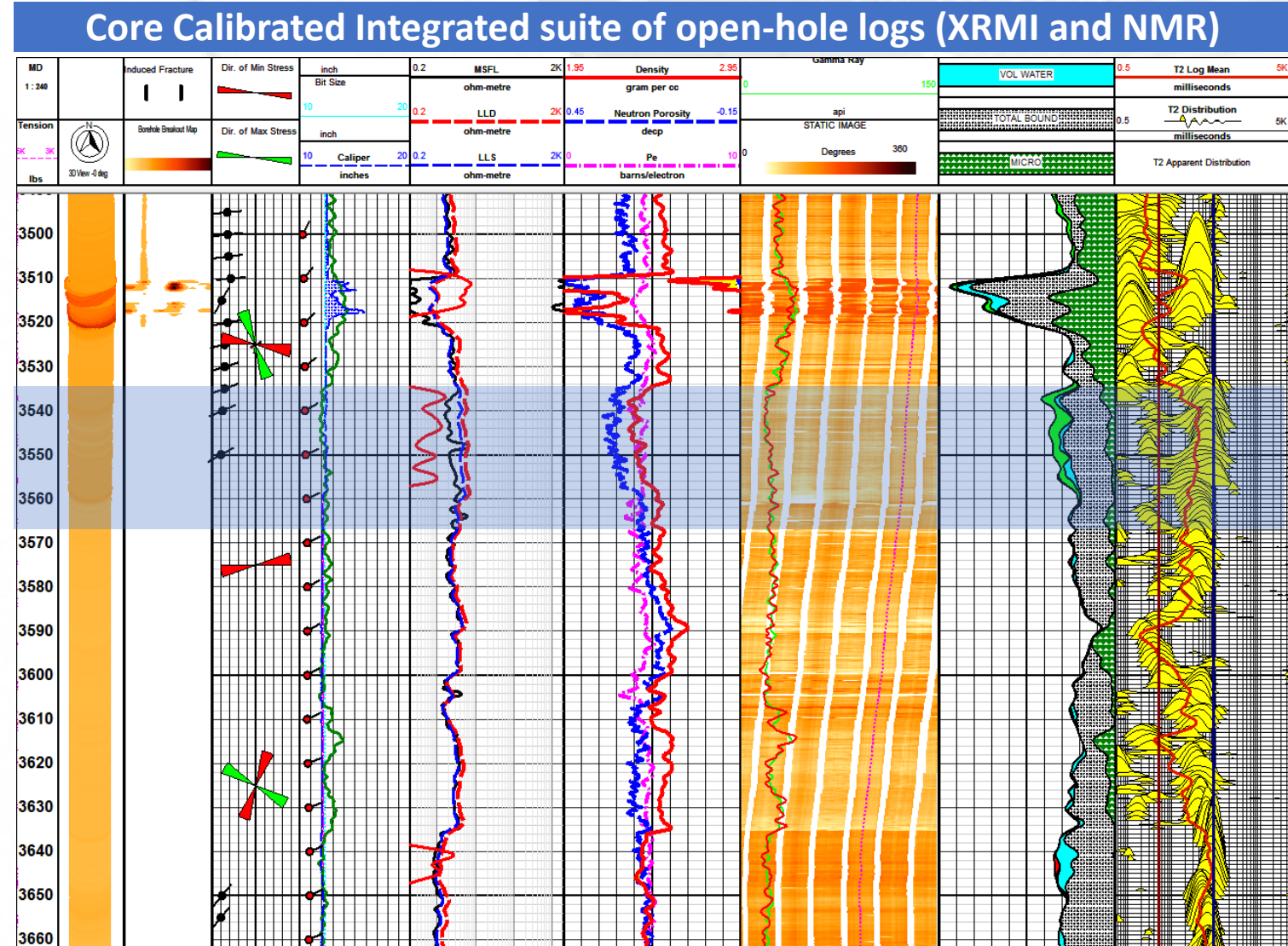


Borehole image

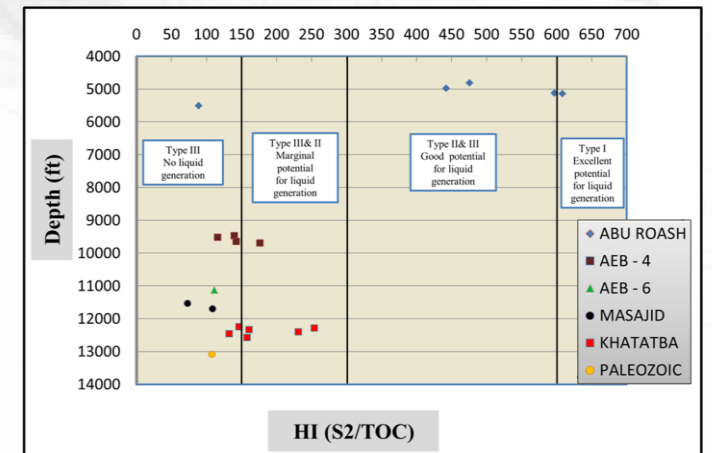
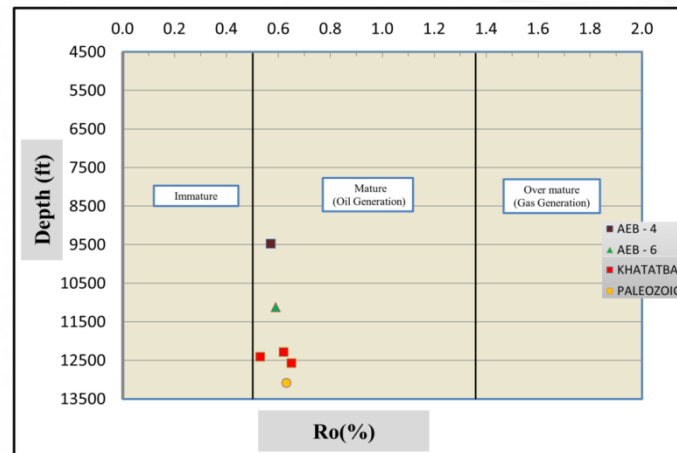
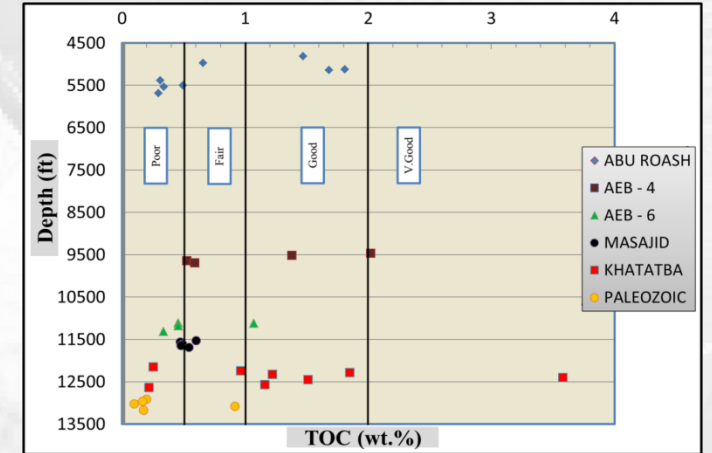
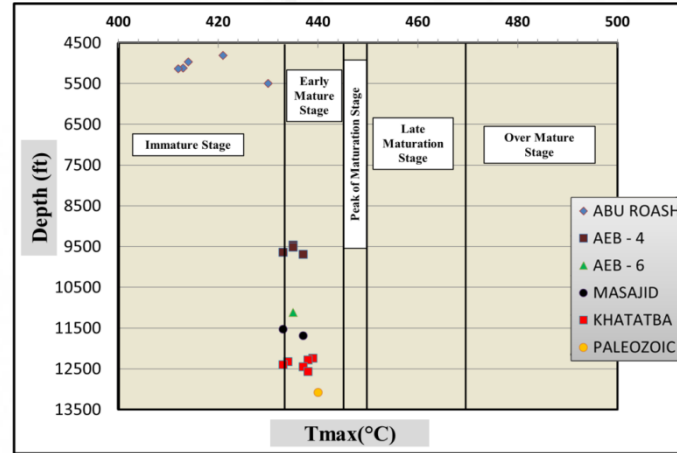
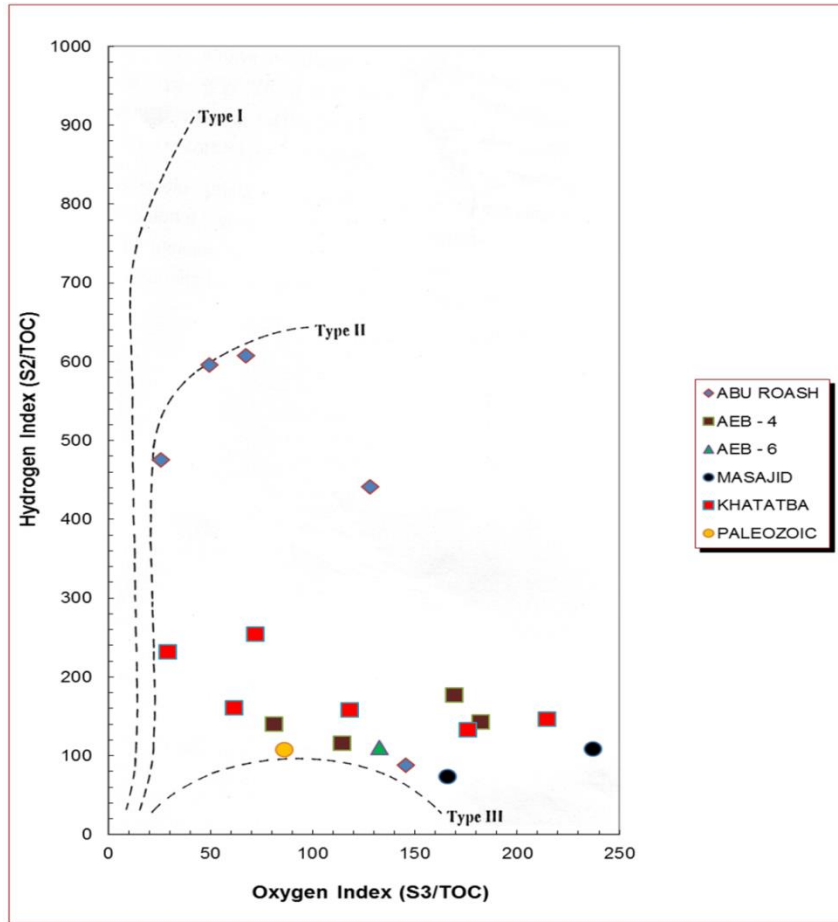
- Reflects neither much of post depositional processes (cementation & dissolution) nor fractures , the Lower Apollonia reservoir in Razzak described as a depositional carbonate.

NMR

- Porosity distribution histogram reflects homogeneous pore-system mainly of capillary bound – micro porosity type.
- Fluid typing reflects presence of oil bearing carbonate.

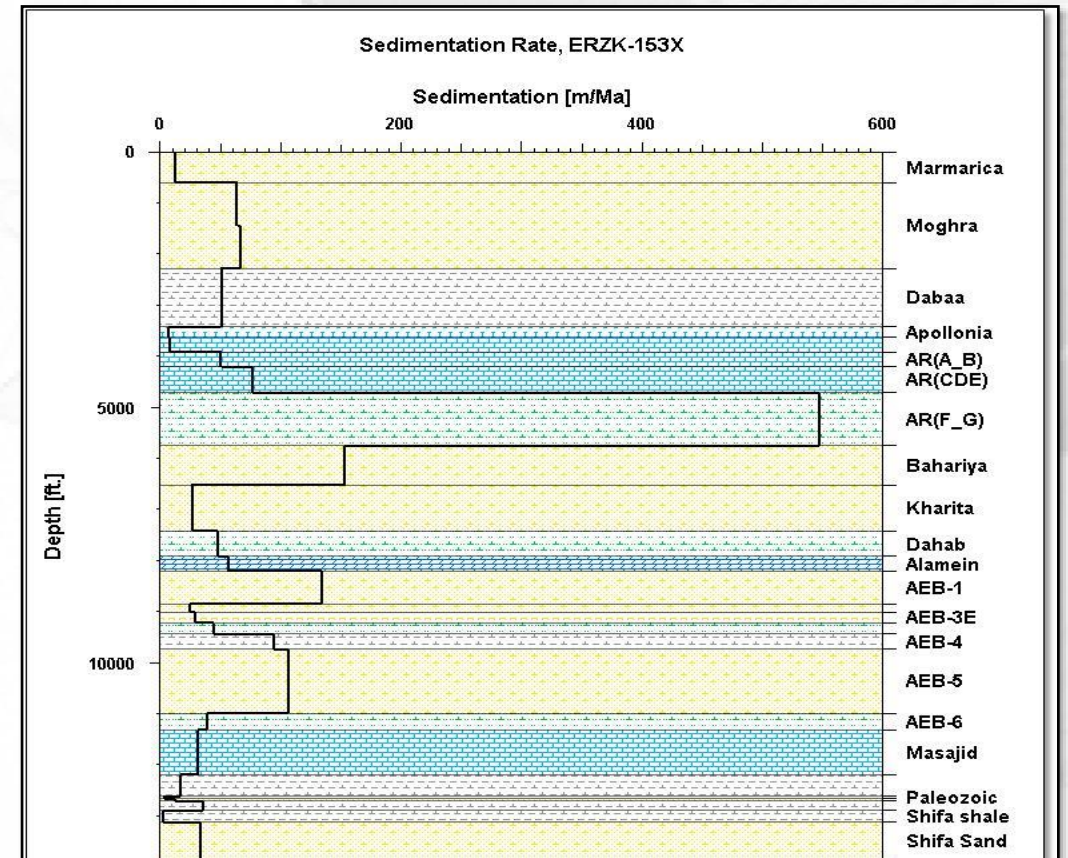
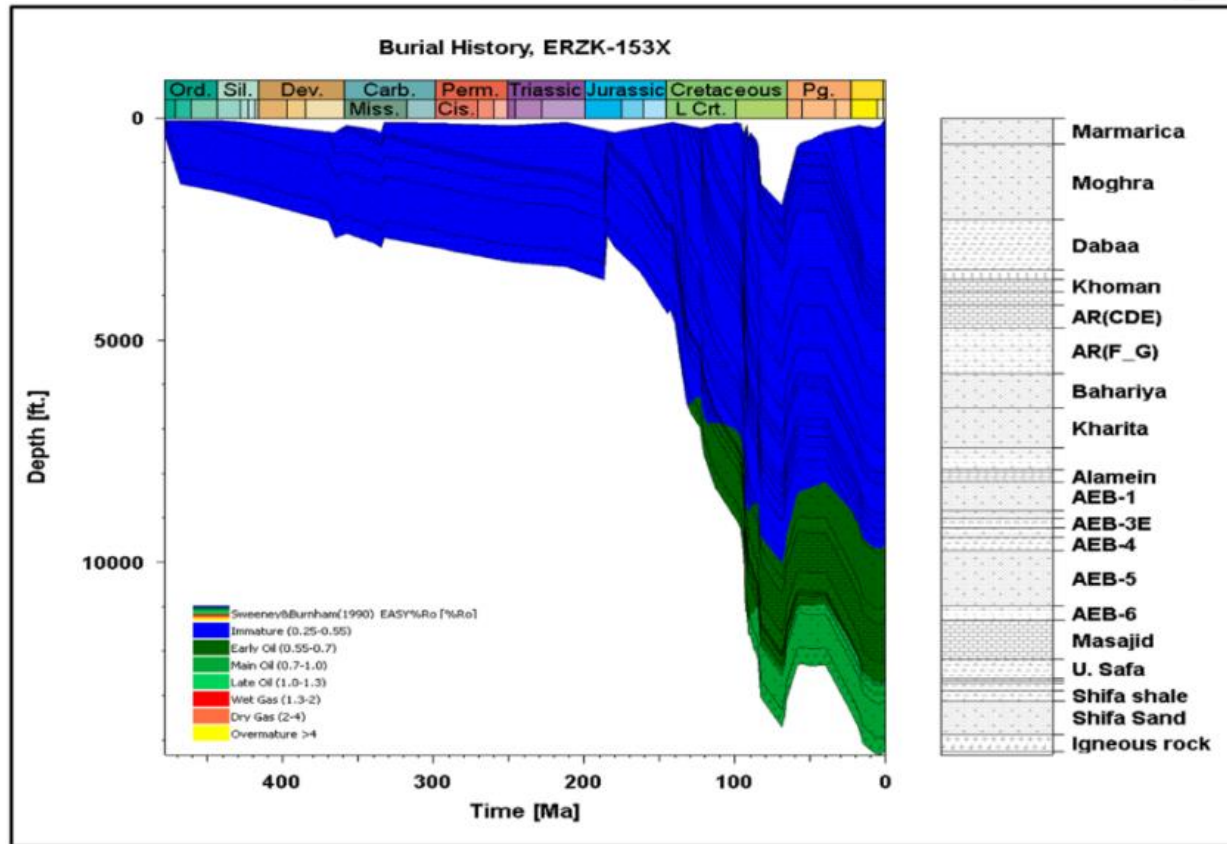


Source Rock Evaluation



A / R - F good source rocks and still in immature stage, while **Khatatba** generally good to very good source rock and located in **early mature stage within Oil Generation**.

Burial History and Hydrocarbon Zones Sedimentation Rate



The Jurassic (**Khatatba**) source rocks might have begun to **generate oil** during **Late Cretaceous**, the timing of oil generation (**~100 Mabp**), also the subsidence during Jurassic age was characterized by very high sedimentation rate.

OIL SOURCE CORRELATION

OIL – SOURCE CORRELATION

Characterization of Oil Based on Bulk Parameters

API Gravity

Sulfur Content

Hydrocarbon Classes

Molecular Biomarker Parameters

Biological Markers Distribution (GCMS)

Normal Alkanes and Isoprenoids (GC)

Triterpanes (m/z 191)

Steranes (m/z 217)

Characterization of Oil Based on Bulk Parameters

API Gravity

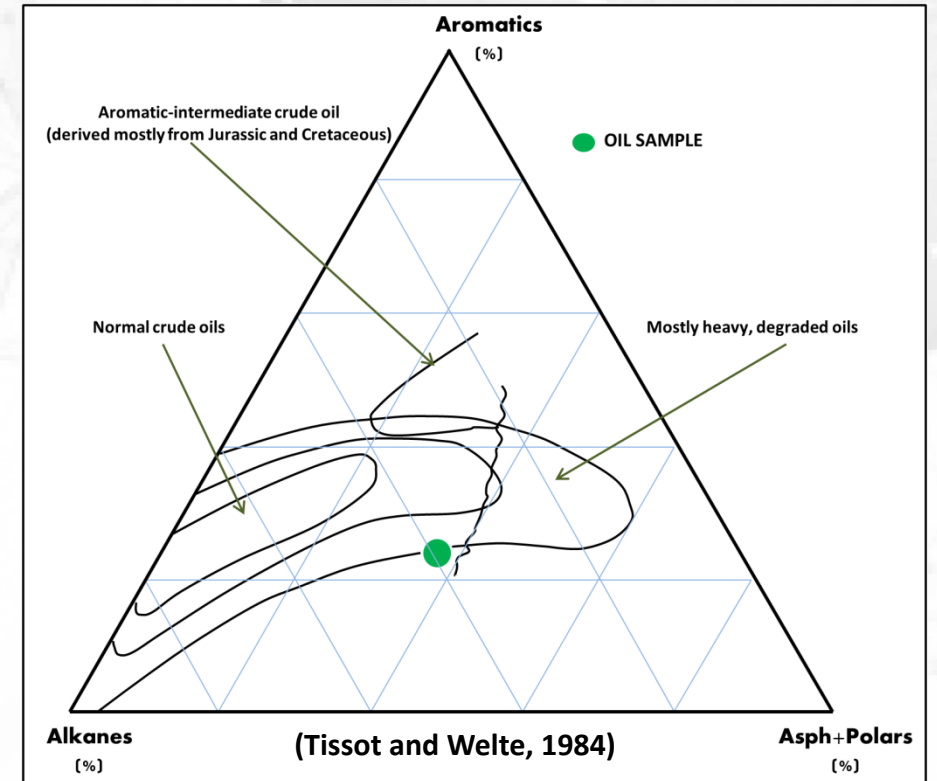
The crude oil sample of **Apollonia** reservoir from **ERZK – 15** has low API gravity value of 14 indicating heavy biodegradation.

Sulfur Content

The sulfur content of oil sample is 2.14 % indicating heavy biodegradation.

Hydrocarbon Classes

The crude oil sample locates within the heavy biodegraded oils class.



Molecular Biomarker Parameters

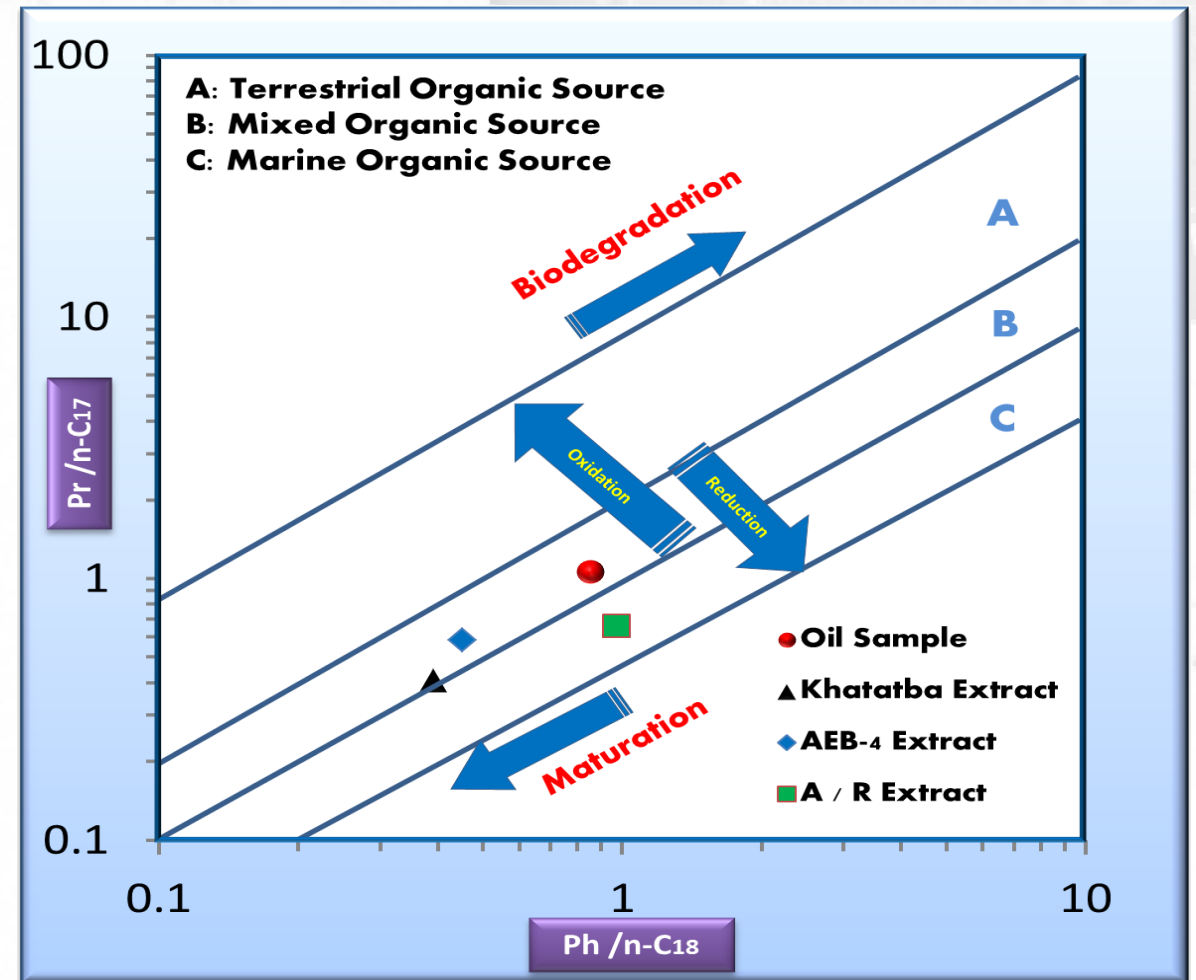
Normal Alkanes and Isoprenoids (GC analyses)

Apollonia Oil Sample

Pr/n-C17 and Ph/n-C18 are 1.07 and 0.85 indicating that oil may derived from mixed organic sources and reflect biodegradation.

Khatatba Extract Sample

Pr/n-C17 and Ph/n-C18 are 0.41 and 0.39 indicating matured sample and was derived from mixed organic sources.



OIL – SOURCE CORRELATION

Depositional Environment

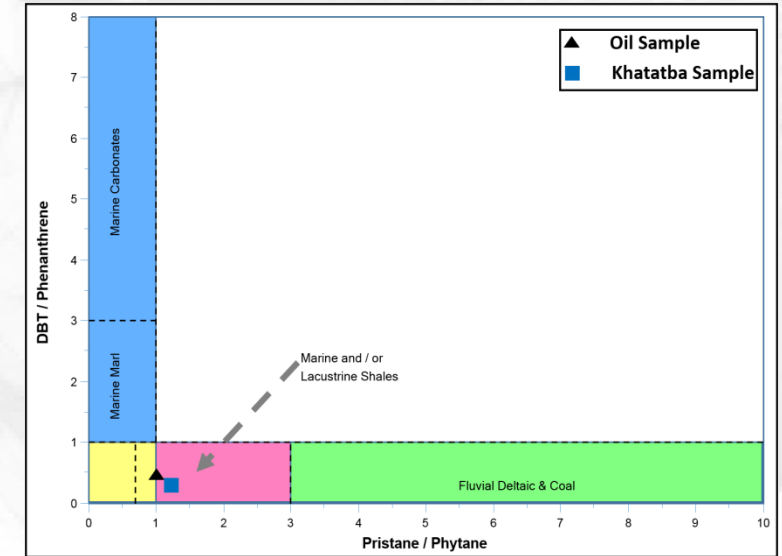
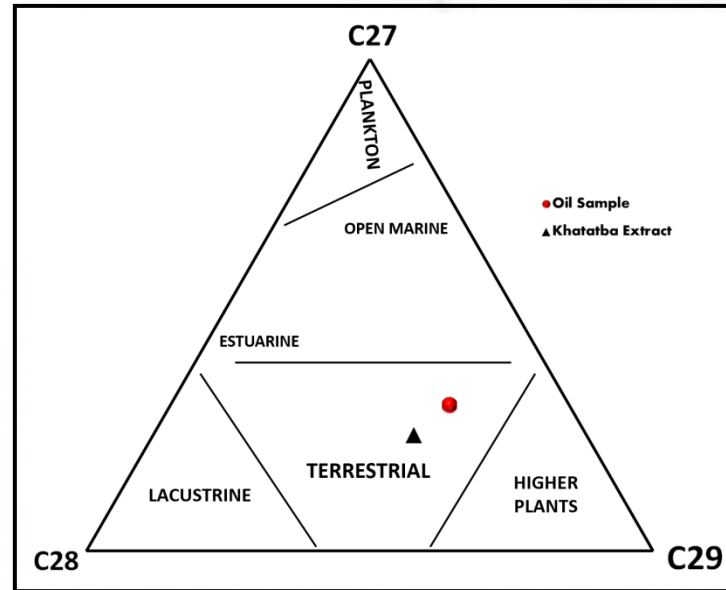
The parameters come from Hopanes, Steranes & Aromatics GCMS analyses illustrate that Apollonia oil has been charged from source rocks deposited in terrestrial environment with marine input under oxic – suboxic conditions.

Facies

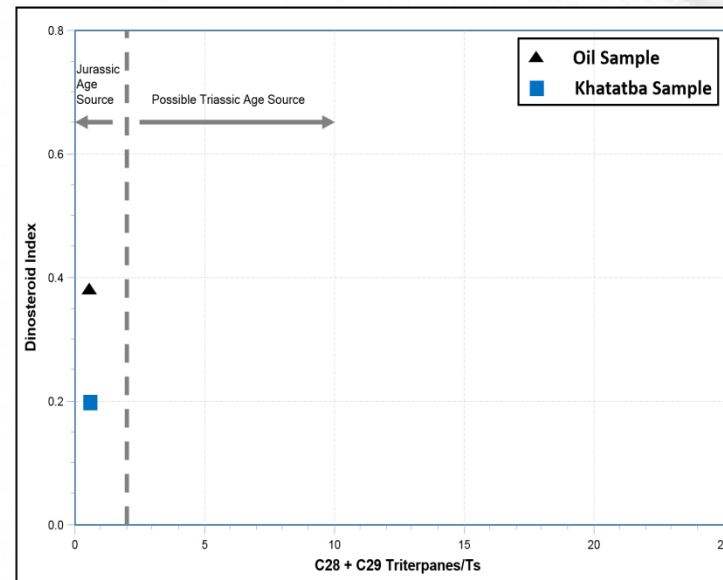
Apollonia oil derived from mixed source rocks have the same facies and properties of Khatatba sources, most probably from marine and non-marine shale.

Age

The oil is supposed to be migrated from Mesozoic rocks especially, from Jurassic source rocks.



(Modified after Hughes et al., 1995)



Both parameters are age-diagnostic biomarkers.

RECOMMENDATIONS

It's very important to check gas system once starting drilling to get accurate readings as gases consider the first indicator for good reservoirs, especially carbonate type

Covering all shallow depths by complete data set of open hole logs (at least quad combo)

Recording cased hole logs for old wells of shallow depths (unlogged intervals) which have good indications from mud log like (High gases or oil shows)

Acid job should be combined with Apollonia reservoir perforation

Re-evaluated and take the risk for testing any abnormal phenomena from time to time

Factors Lead to Success





THANK YOU