Stratigraphic Control of Upper Pondaung Sandstone, Letpando Oil Field, Central Myanmar Basin*

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Abstract

Lepando Oil Field is located in the northernmost part of the Salin Sub-Basin of the Central Myanmar Basin. Historically recorded high flowing rates but short producing times of thick crude oil has been tested and produced in the Letpando area from the Mid-Eocene fluvial Pondaung Sandstone reservoir which was encountered by first exploration well in 1974; many appraisal wells (total of 15 wells) were being followed up periodically to delineate the reservoir extent during the last 3-4 decades. All wells encountered very high pressure shale in the Yaw Formation before reaching the target Upper Pondaung reservoir and drilled with high density mud to overcome it. Wells are permitted to run only a basic log suite under the high pressure conditions. Well conditions also leads to poor cement bonding in final casing setting in most of the wells. MOGE also discovered lighter oil potential prospects in shallower depths as a consequence, in the Lower Oligocene Shwezettaw Formation (SZT) sandstone which is more favorable and now gaven priority to develop commercially in later stages. Intensive infill wells were located mainly for the SZT Sandstone target for major production today. The last attempt of Upper Pondaung targeted wells was drilled successfully with high mud weight in 2012, but testing results showed only formation water flowing with high pressure.

Stratigraphic Control of Upper Pondaung Sandstone, Letpando oil field

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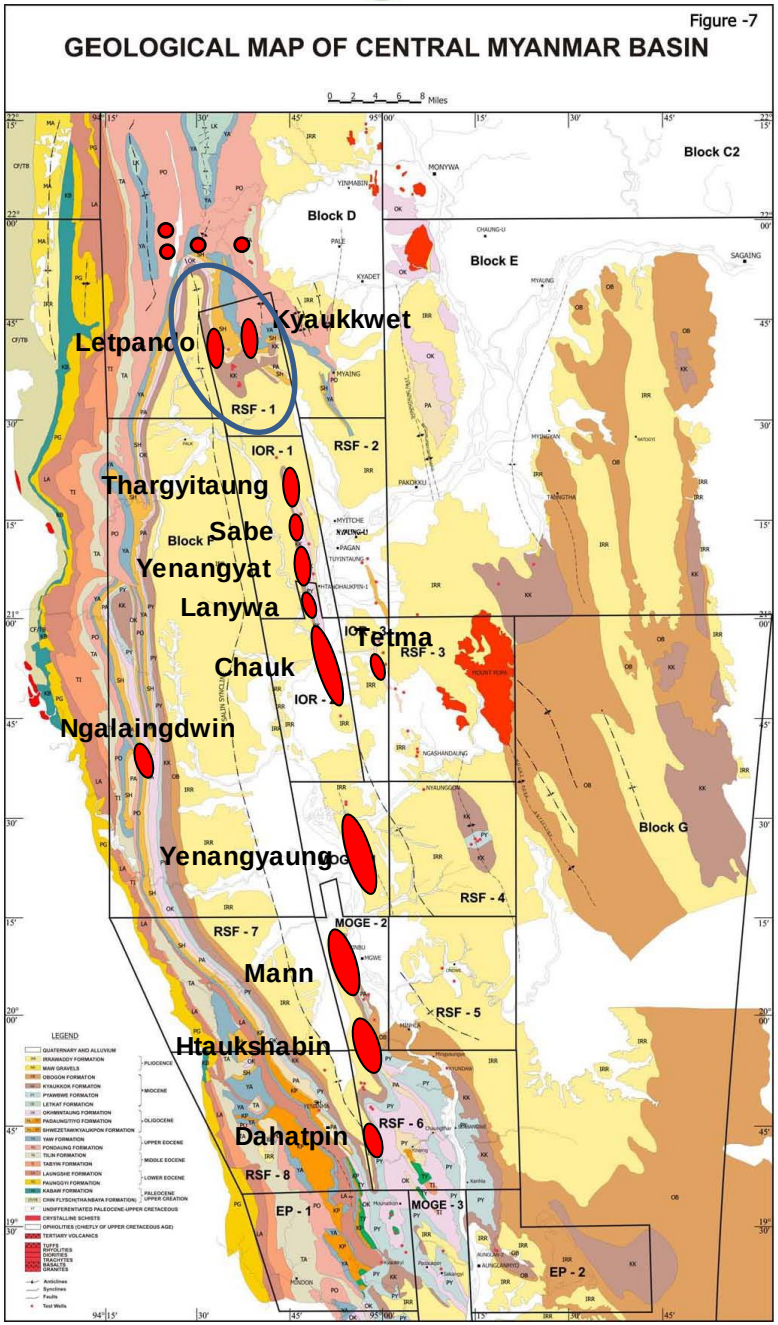
MOGE

Objective of Study

- Qualitative study of stratigraphic control on Upper Pondaung fluvial Sandstone within area of Letpando field
- Finding possible fluvial geometry which is likely to fit regional geology background ,the existing available data ,well log result and the past reservoir testing
- To understand it's reservoir and hydrocarbon distribution
- To capture reservoir concept for model framework

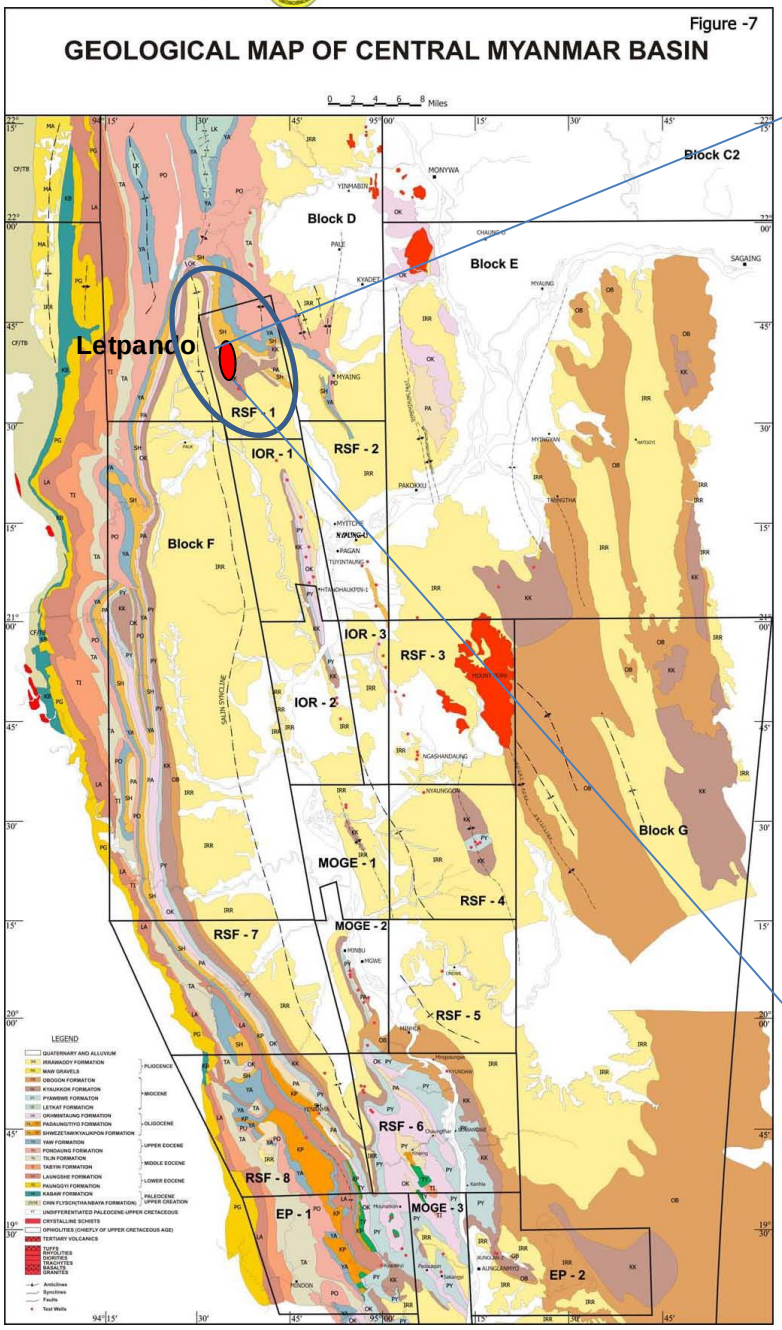


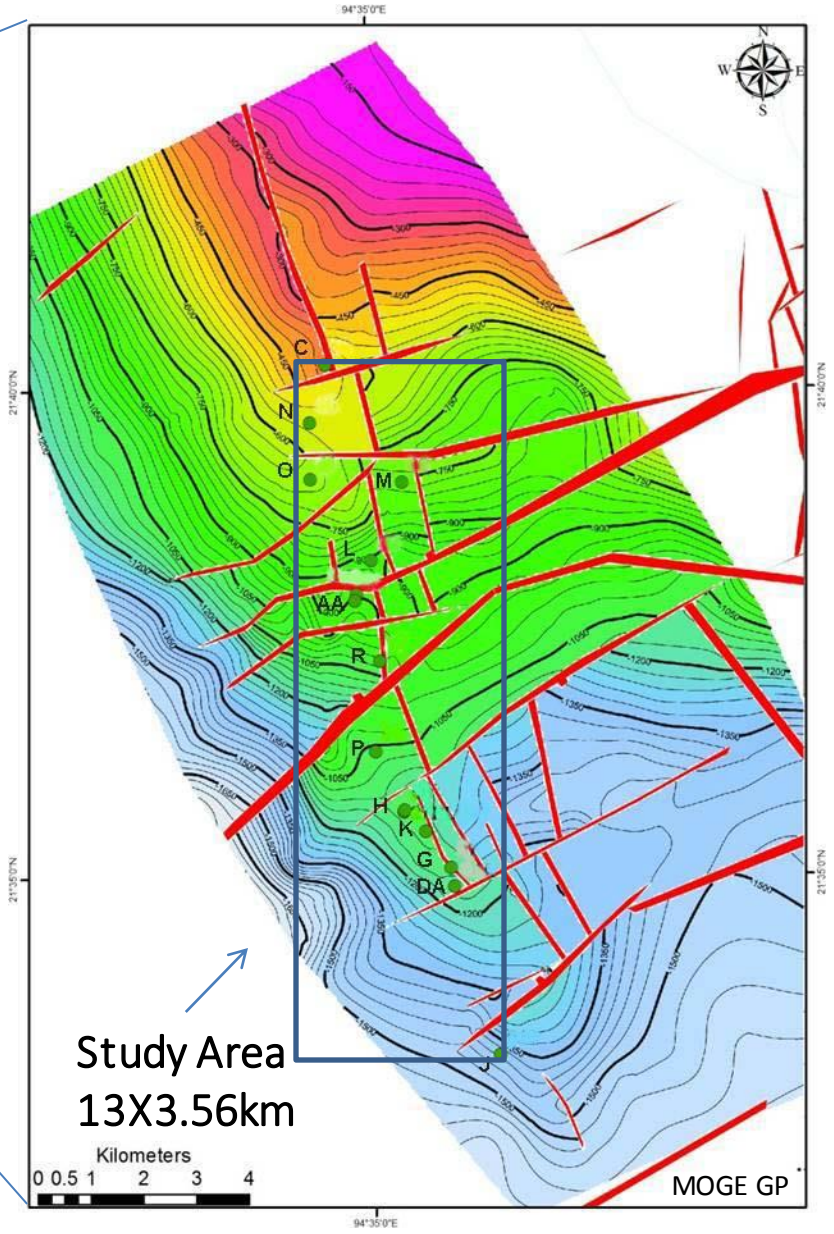
CENTRAL MYANMAR BASIN

- Located between 22° N and 20°N uplift areas.
- 140 Miles long, 45 Miles wide, showing NNW-SSE striking anticlinal trend.
- The Salin and Taungdwingyi synclines are major depocenters and a total of 50,000 ft of sediments recorded.
- Composed of the Cretaceous through Tertiary to Recent
- The main petroliferous horizons are in Oligocene to Miocene sediments of marine, fluvio-deltaic sequences.
- **Eocene reservoir have been proved** in northern part of Salin Basin, **LetPanDo & Kyaukkwet Oil field**.
- Potential source rocks- Pyawbwe , Yaw,Pondaung , Tabyin and Kabaw Formations.

Figure -7

GEOLOGICAL MAP OF CENTRAL MYANMAR BASIN





TOTAL 18 wells from 1974-2013

Geology of Kyaukkwet Letpando area

Mid–Eocene Continental, Fluvial condition with Coarse-grained Sandstone and red and motted clays of PO formation.

Upper–Eocene Subsidence with subsequence deposition of the Argillaceous Yaw under inner neritic. Presence of interbedded, thin current bedded sandstone locally abundant of shell fragment in thick sequence of clay, occasional carbonaceous clay

Early–Oligocene Regressive phase ,resulting in the deposition of near shore and deltaic Sandstone of SZT formation.

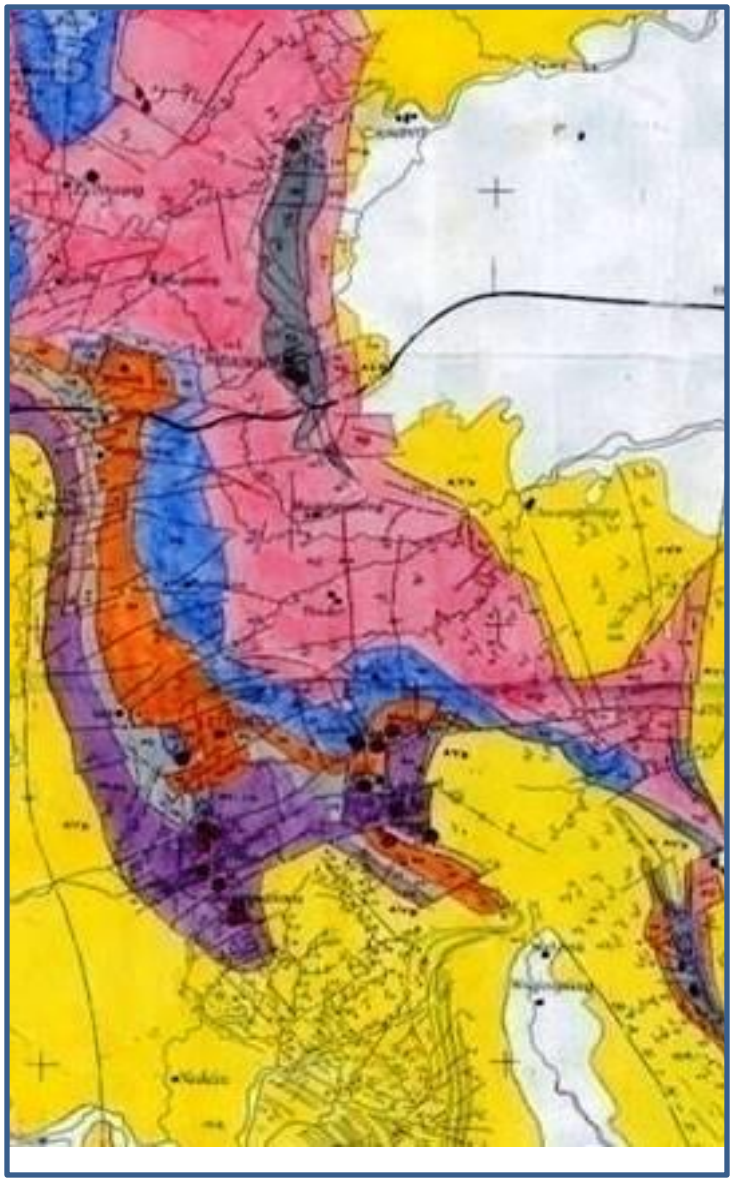
Mid–Oligocene Subsidence and deposit of mainly argillaceous PA formation.

Upper-Oligocene to Lower Miocene Area Uplifted, Major structure trend **was established by minor earth movement.**(no exact timing).Absence of OK. Area remained uplifted throughout the L-Miocene ,PY not reached to North.

Latter part of Miocene -Once again uplifted, deposit of KK

Pliocene Rapid influx of coarse fluvitile sandstone of AYD and followed by **the** final folding and thrusting movements .

PLIOCENE	AYEYARWADDY	1400' +
MID MIOCENE	KYAUKKOK	3000'
MID OLIGOCENE	PADAUNG	1700'
LOW OLIGOCENE	SHWEZETTAW	2060'
UP EOCENE	YAW	2080'
MID EOCENE	PONDAUNG	940'



Exploration History

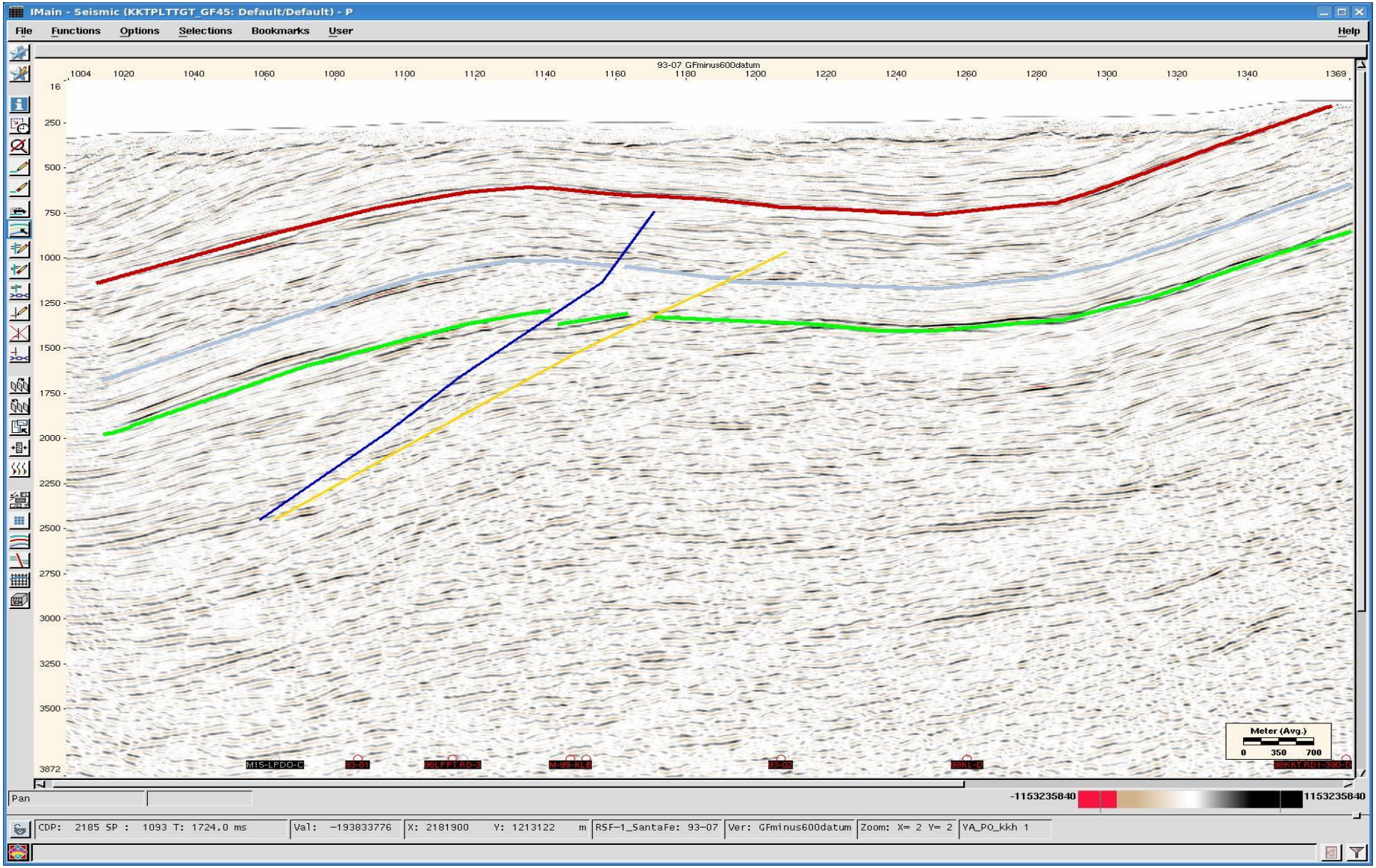
-Geological survey has been conducted since the year 1909.
-**MOGE** extended its detail geological mapping in 1972.
-Shot one regional seismic line in 1973-74.
-During the years 1974-79, **MOGE** has drilled 10 wells on the Letpando structure. 7 wells reached target.
-In 1993, **Santa Fe Energy Resources of Myanmar Ltd**. acquired 336.5 Line kilometers of 2D seismic lines and assessed its oil and gas prospectivity.
-Another 8wells had reached Pondaung formation target until date.

<u>Among Total of PO Target (18) wells</u>
-First well in 1974 (testing result showing max 2160 bopd with gas flowing) .
-Then another 5 wells in success and initially gave fair -good production (2 - 320 bopd) but unable to produce after few days due to various reasons .
-Mainly due to the completion problems (heavy mud weight) ,muddy sand contaminated in flow and possible of narrow formation drainage area.

W

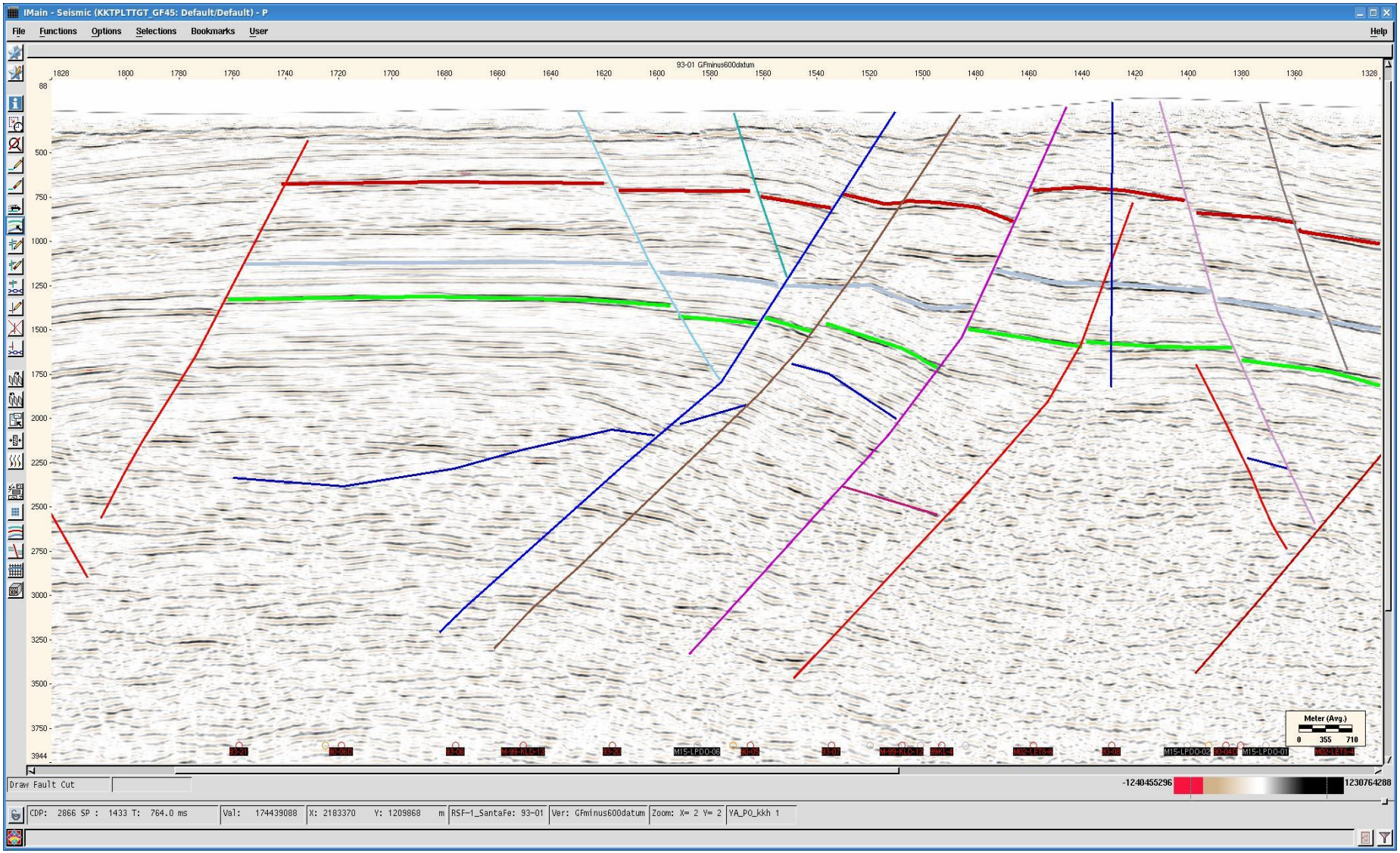
Structure configuration EW

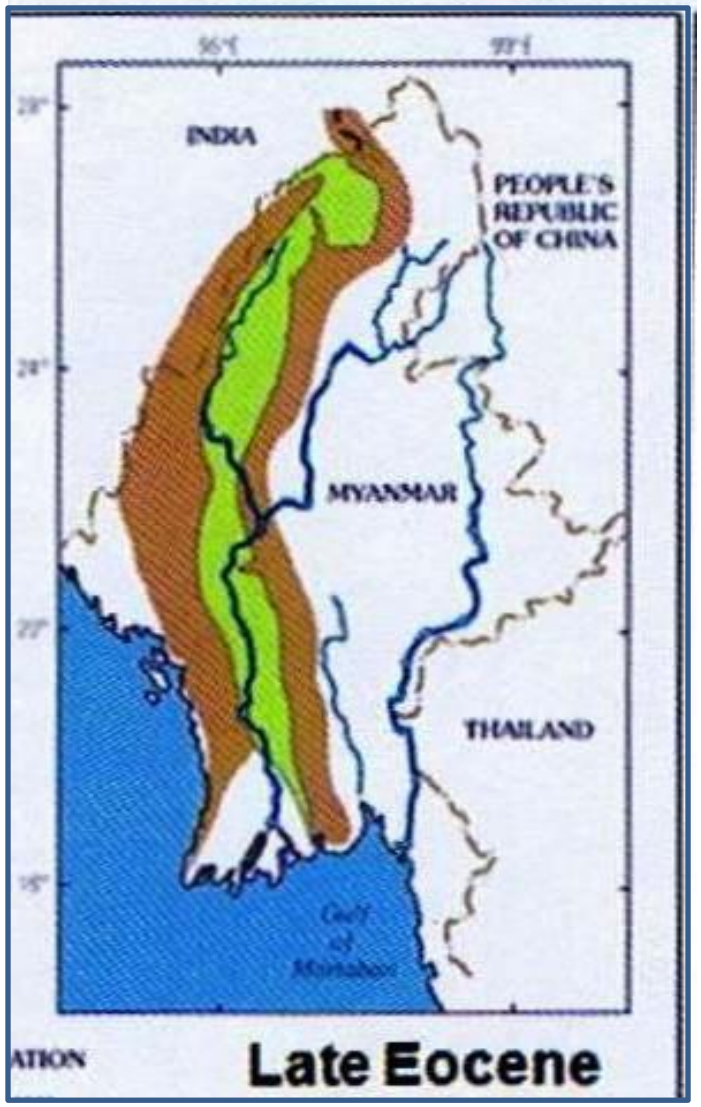
E



Longitudinal section NS

N S





Available data

Surface Geology Field data
- nearby area (NE and SE area)

2D Seismic
- structure configuration

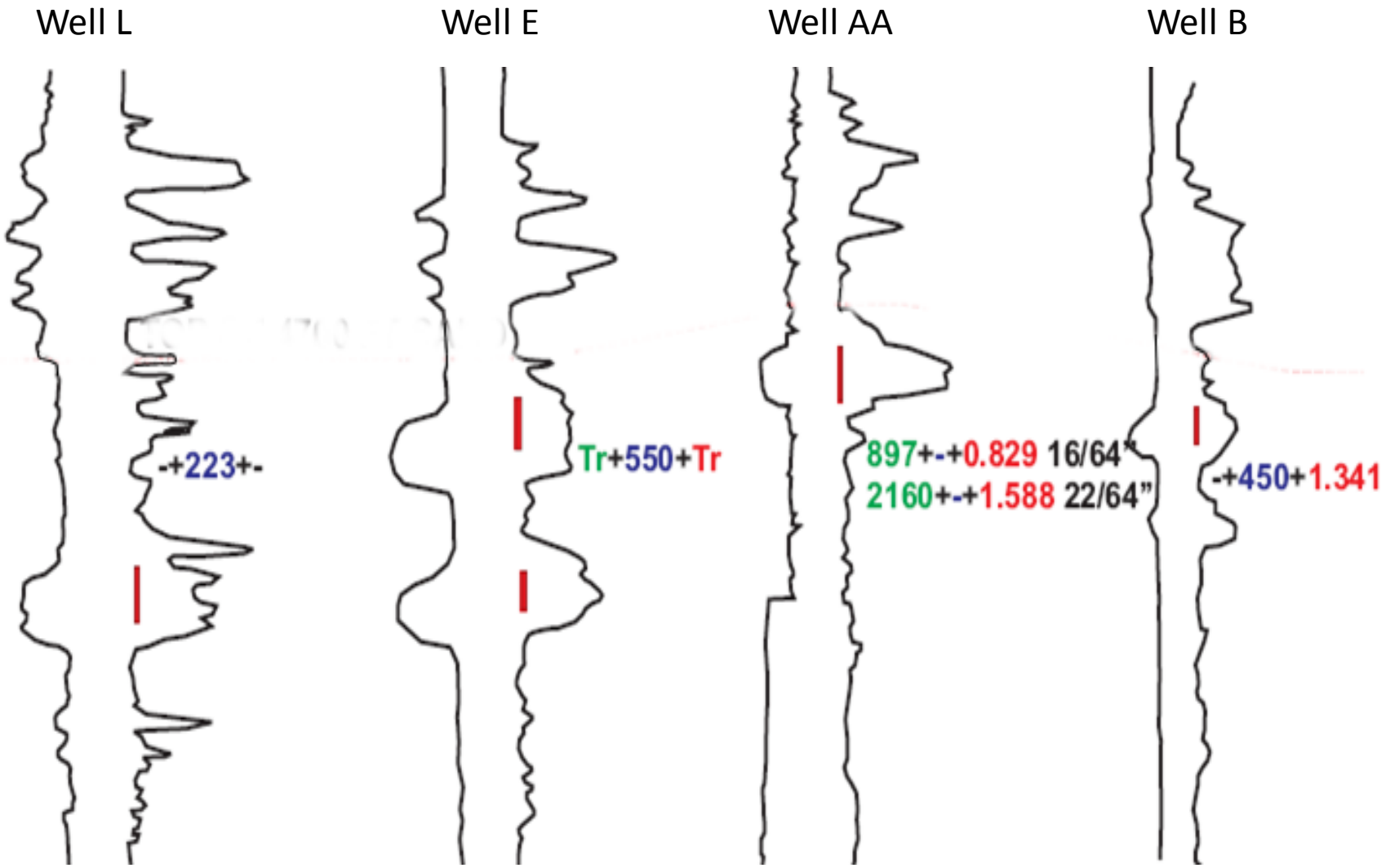
Wells data
- Limited

Conventional well log
- SP,RES ,
- limited data of GR,DT,LDL-CNL

Well Testing results
- Limited

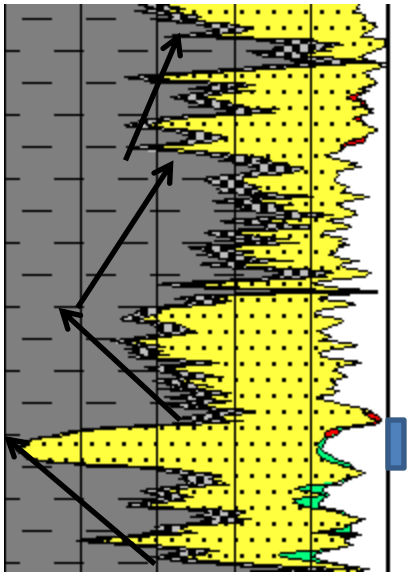
18 wells Data but few left only and available due to various reasons .

OLD LOG


Well L
Well E
Well AA
Well B
-+223+-
Tr+550+Tr
897+-+0.829 16/64"
2160+-+1.588 22/64"
-+450+1.341

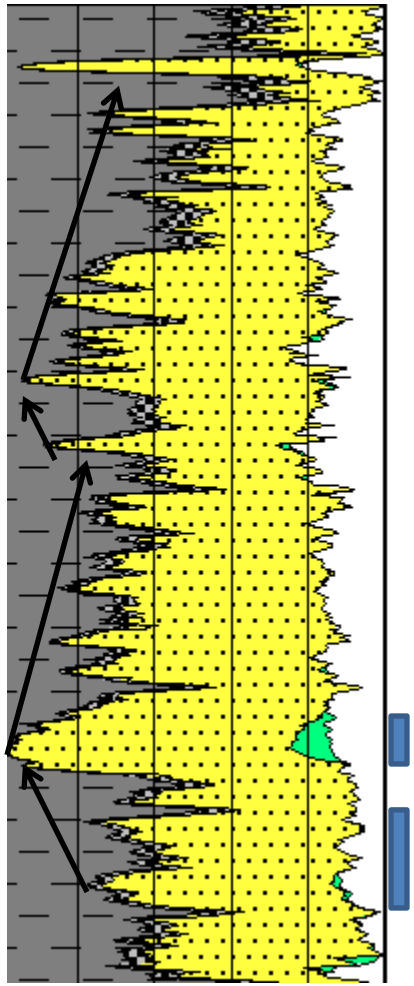
By Modern Well Log

Well R



SW 50%

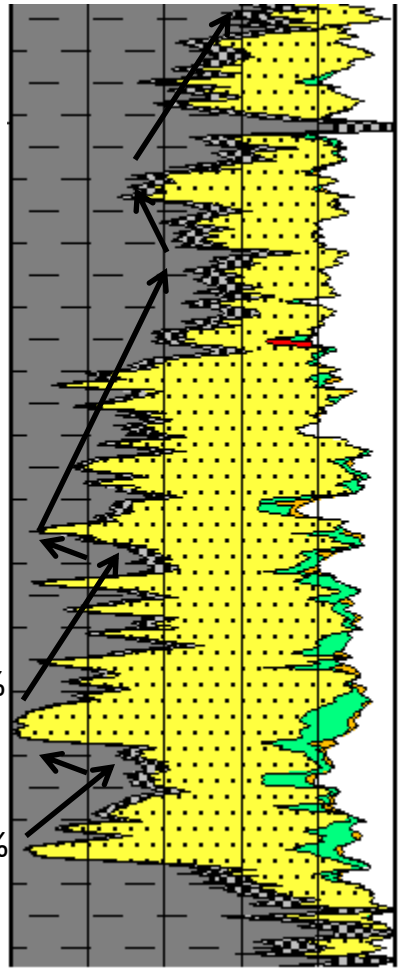
Well P



SW 60%
135
BWPD

SW 80%
1299
BWPD

Well K

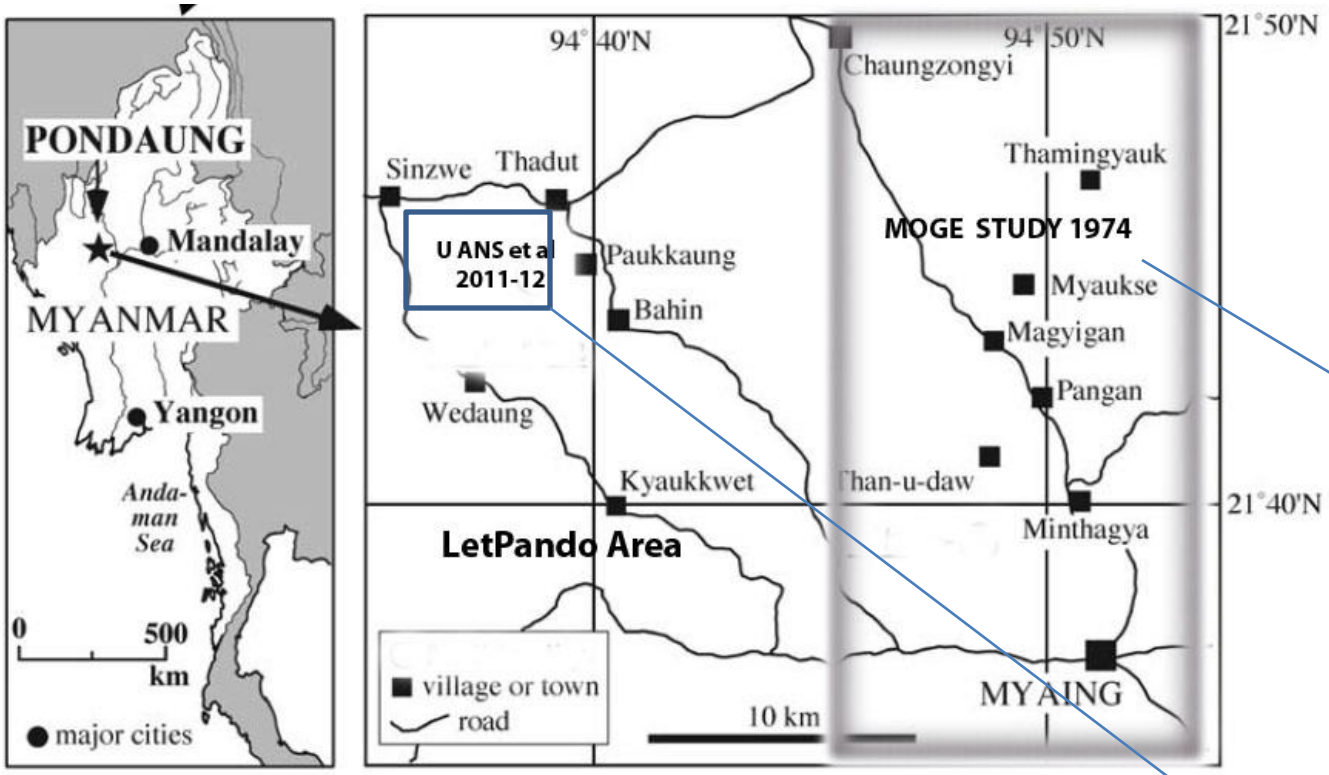


SW 40%

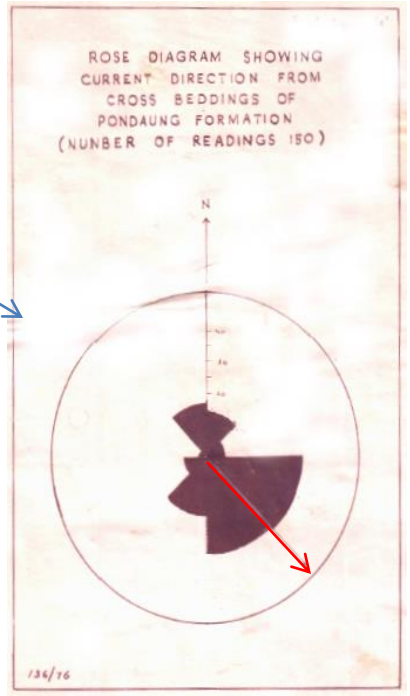
SW 60%
326
BOPD

SW is non linear with resistivity RT in fluvial formation having low salinity RW

Previous Paleocurrent studies nearby area



MOGE Study



U Ag Naing Soe et al 2011-12

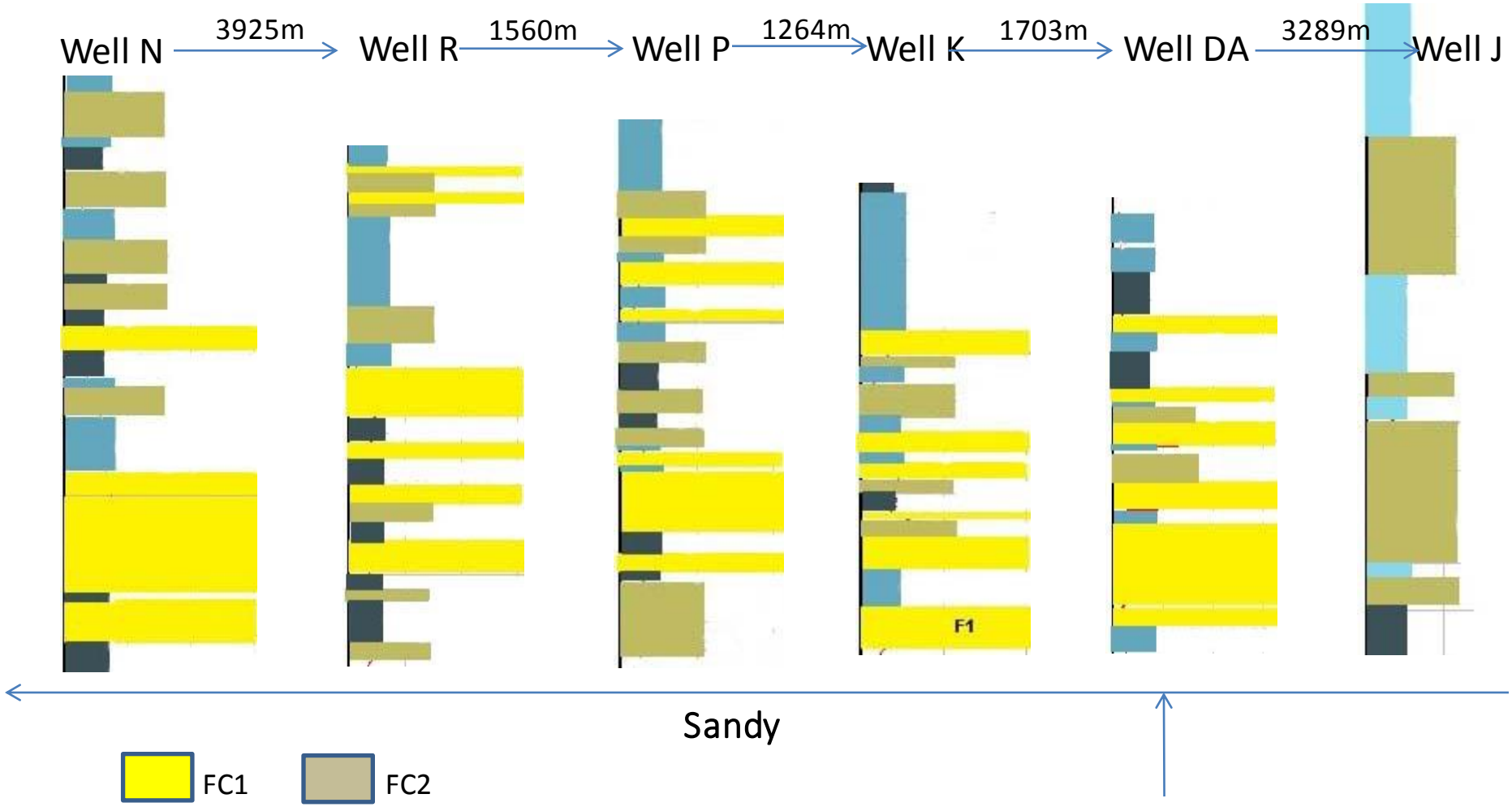
Rock Unit	Location	directional indicators	Data	Mean paleoflow direction
Pondaung Fm	Minbu Sub-Basin, Myaing District	Trough cross bedding (facies St of Aung Naing Soe et al., 2002)	278 crossbeds on 66 distinct channel bodies	243°
Yaw Fm	Chindwin Sub-Basin, Kalewa township	Trough cross bedding (facies St, this paper)	171 crossbeds on 37 distinct channel bodies	257°

Data Preparation

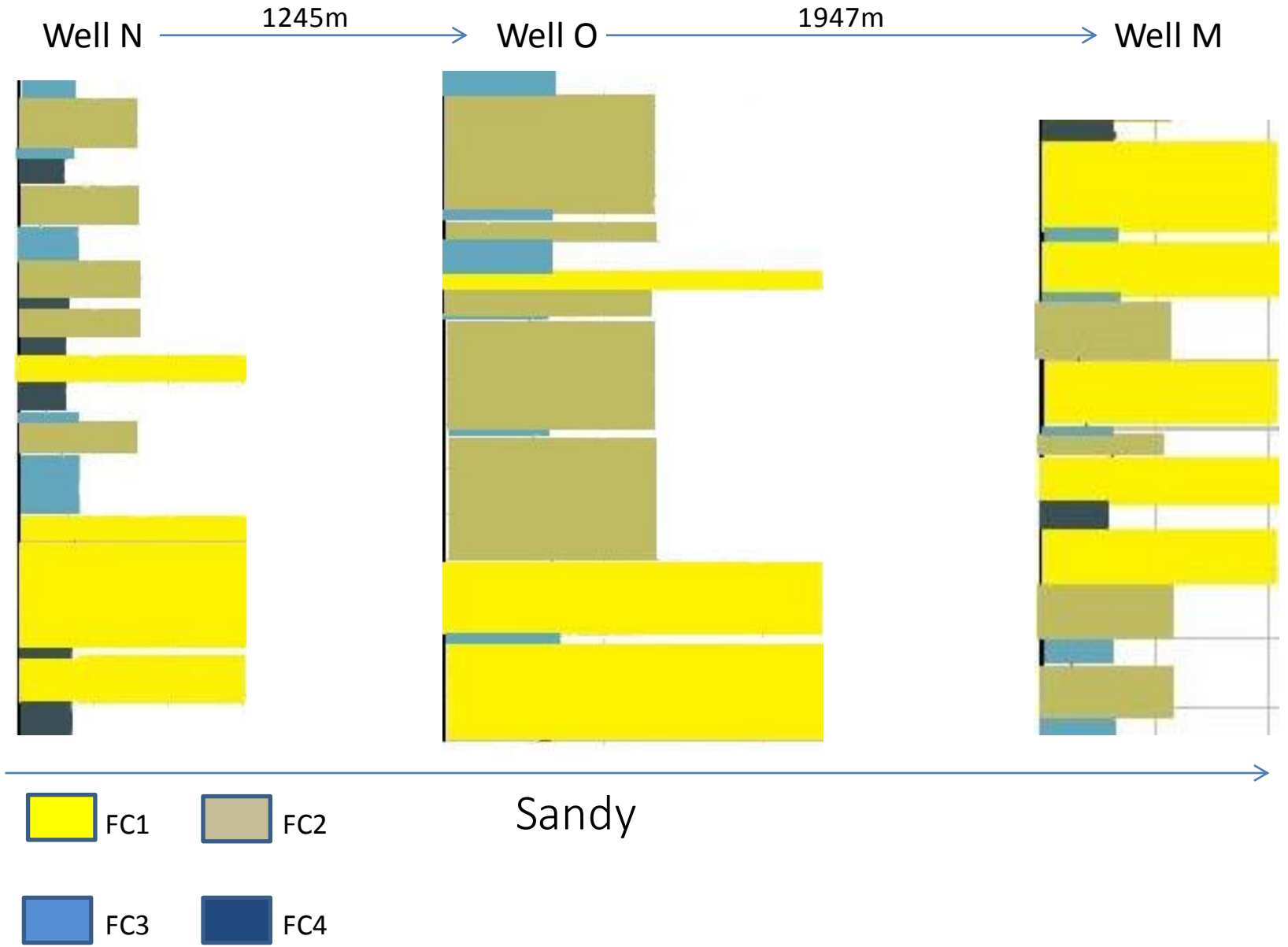
-Data Collection and Digitization well Logs from Old Hard Copies
-Make Correlation wells EW and NS directional section
-Make Electrofacies Log
-Create Pseudo Sonic Log from Resistivity for well having sonic porosity log (Smith method)
-Create Pseudo Sonic Logs for wells not having porosity log using calibrated parameters
-Calculation Porosity for every wells
-Make Net reservoir thickness map (filter above Res 5 ohm and Cutoff Porosity 8%)
-Calculation Net Reservoir thickness and Gross interval thickness ratio
-Make NTG Map
-Make resistivity map (Avg Mean Resistivity after filter clay resistivity well by well)

Electrofacies Logs Showing North to South

N S

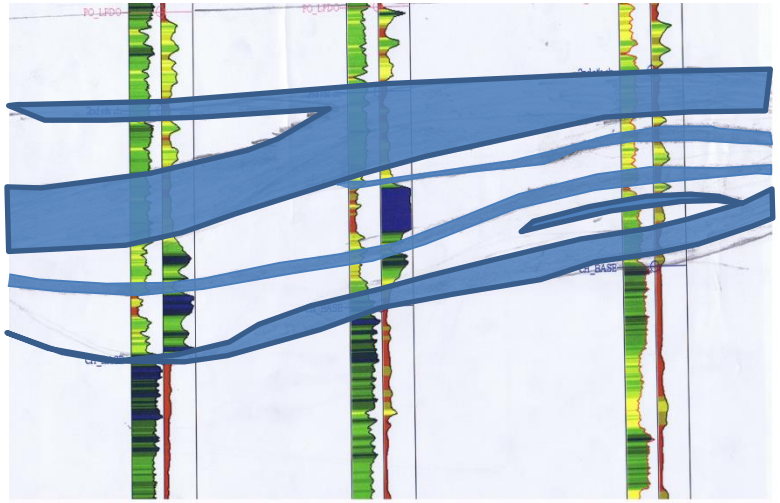


Electrofacies Logs Showing West to East (north)



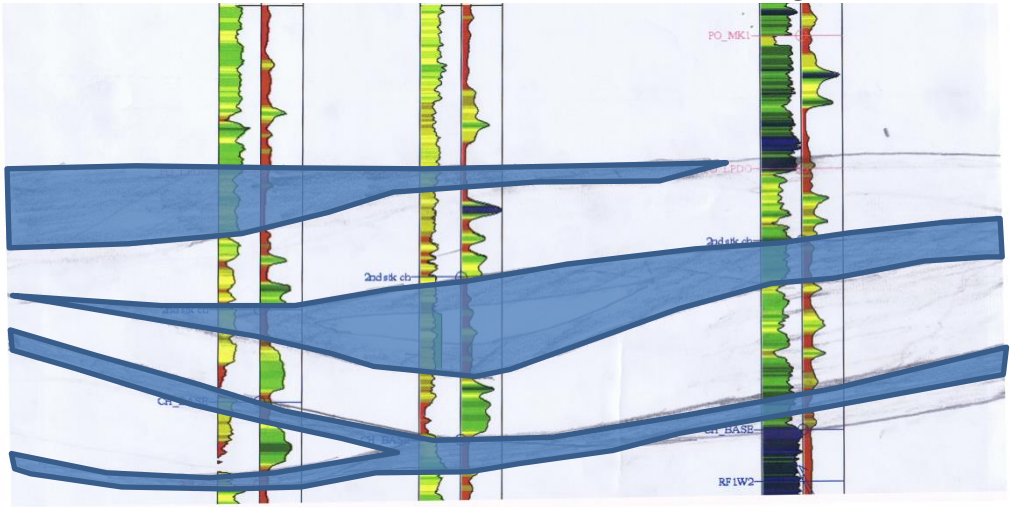
Correlation among wells

Well N → 1245m → Well O → 1947m → Well M



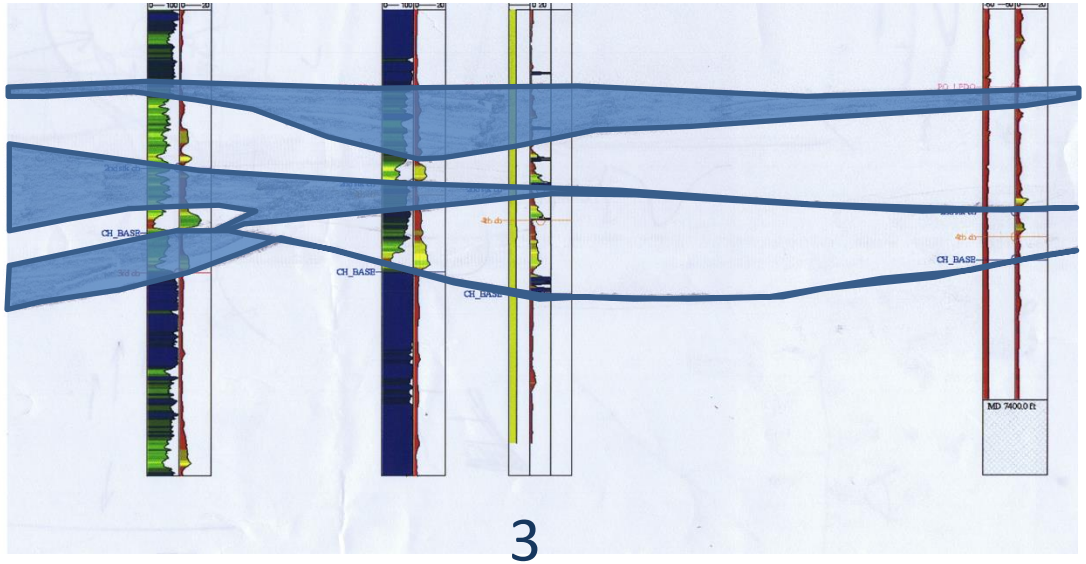
1

Well E → 729m → Well L → 1593m → Well M



2

Well K → 1374m → Well F → 363m → Well DA → 3289m → Well J



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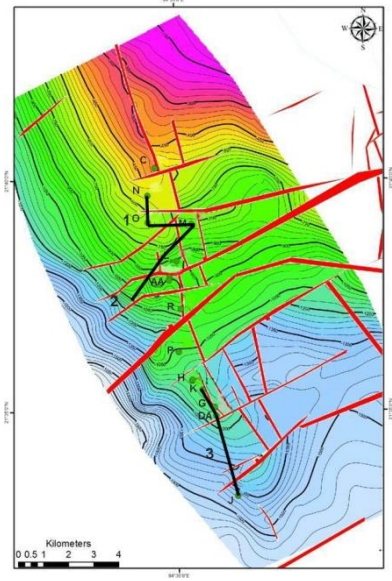
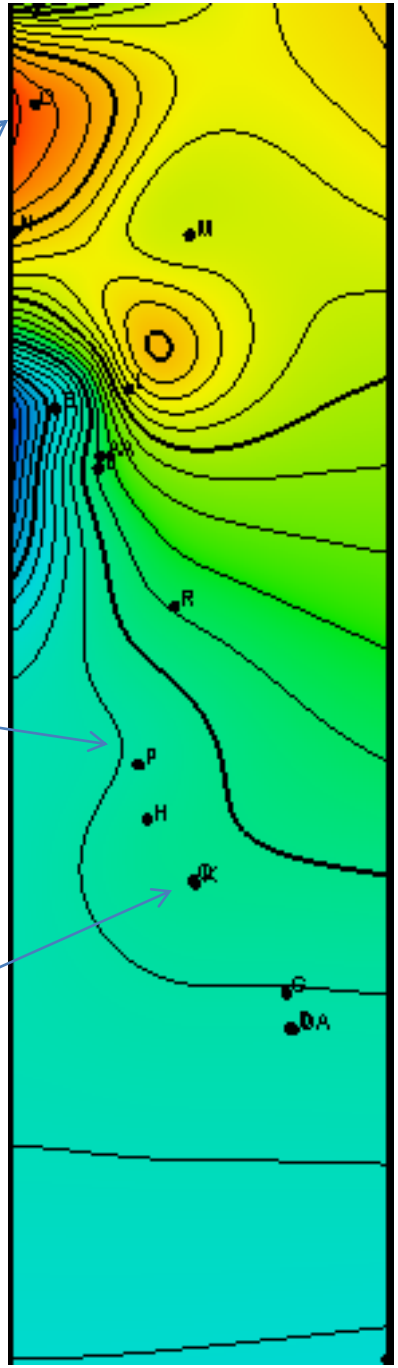
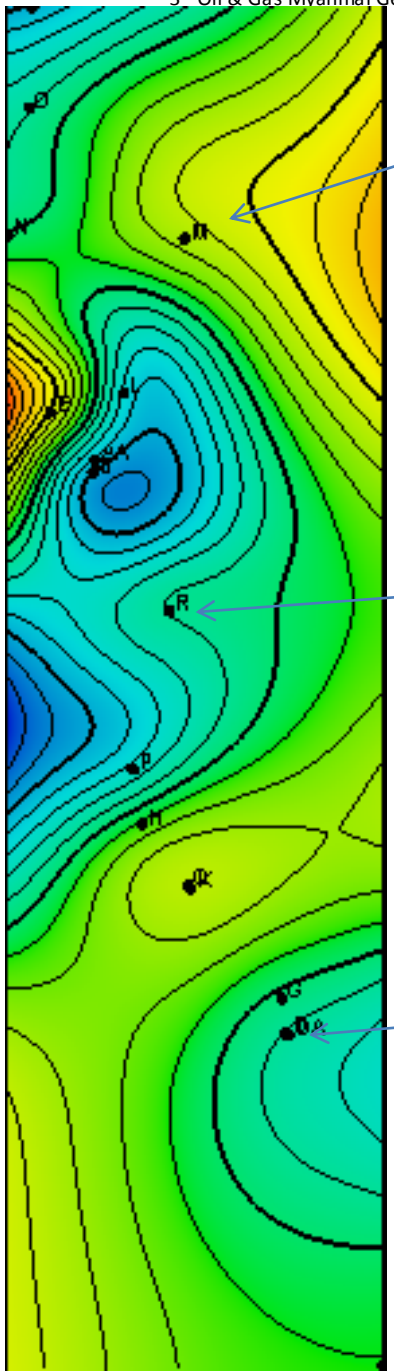
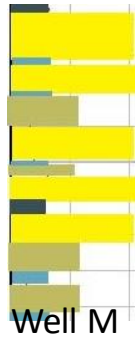


Reservoir Thickness and NTG Map

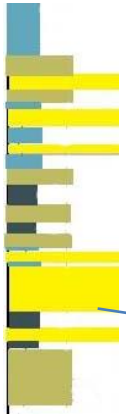
Well N



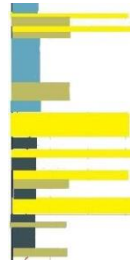




Well M

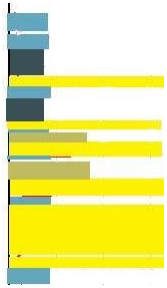


Well P

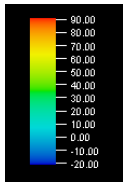


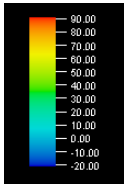
Well R

Well K

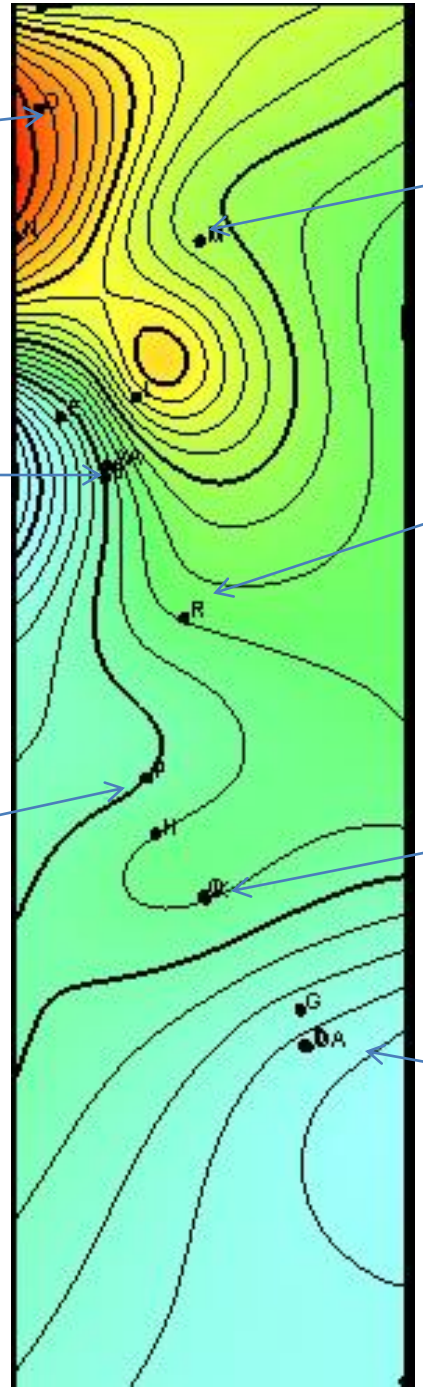


Well DA

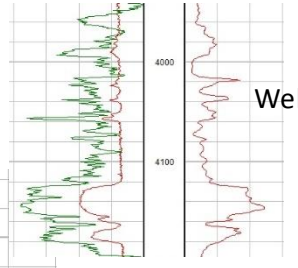




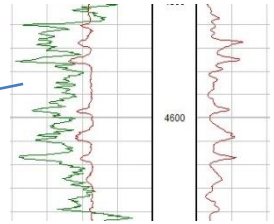
Resistivity Map



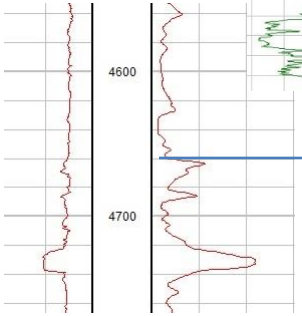
Well N



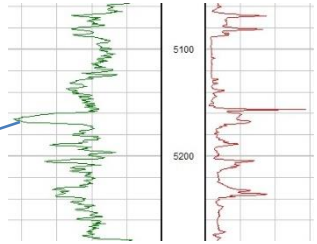
Well M



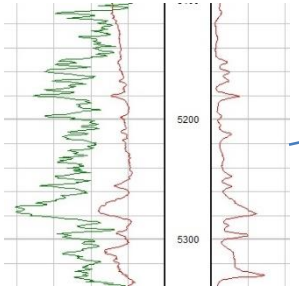
Well AA



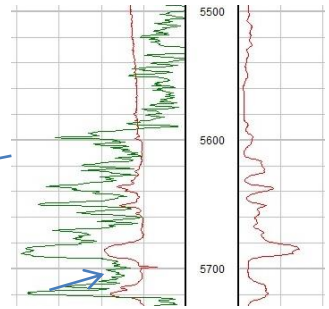
Well R



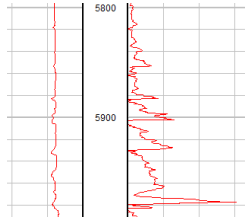
Well Q



Well K

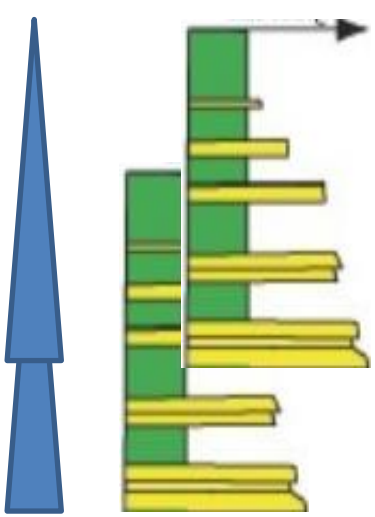


Well DA

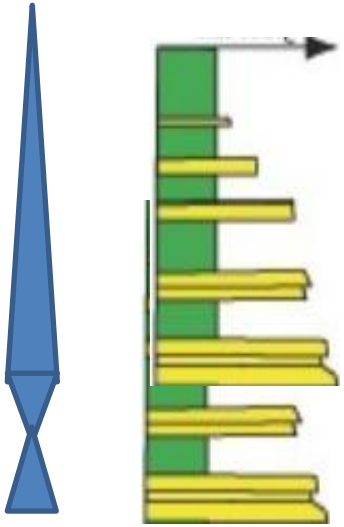


CONCEPTUAL MODEL LIKELY TO FIT DATA

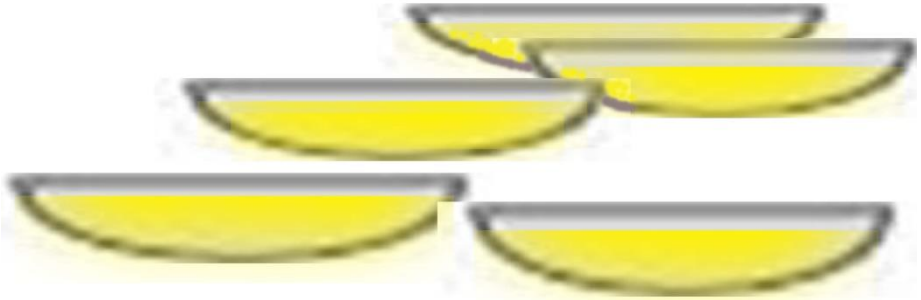
Fluvial channel (Distal)



2 stacks channel



Relative preservation when channel belt occupied the same geographic position at different time



high A/S
Background overbank

J. C. RAMÓN*[1] and T. CROSS[2]

Conclusion

-Main channel and Point bar sand development
-Reservoir thickness thinner from NNE to SSW
-NTG pic likely to show channel geometry (NS main trend , swing NNW-SSE and NNE-SSW)
-Lateral and vertical stacking pattern show how channel sandstone preserved (degree of lateral stacking high to the west)
-Deposited coarser grain in upstream
-low resistivity associate with H/C in downstream where is short distance from basin more favorable for H/C accumulation in combination trap