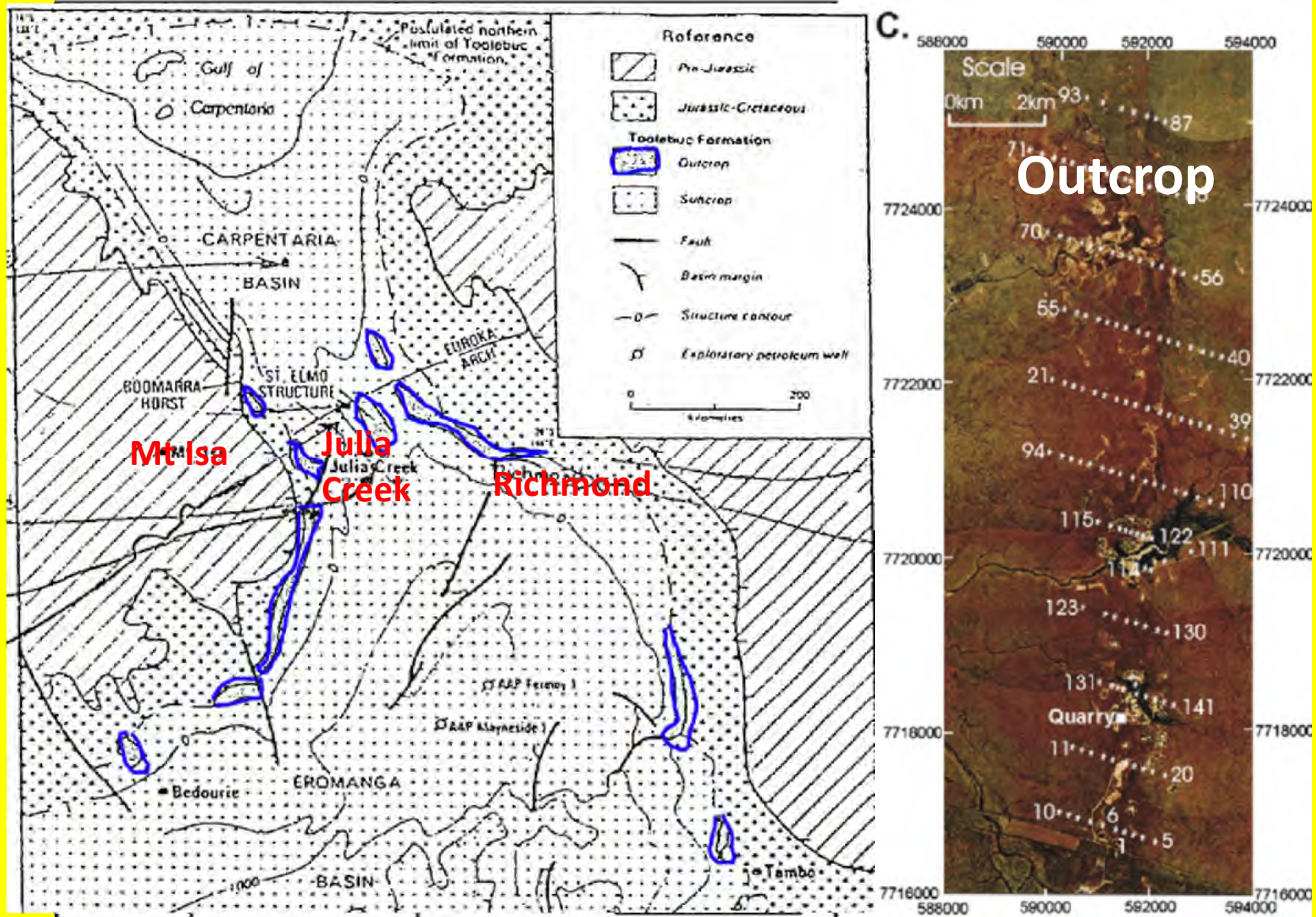
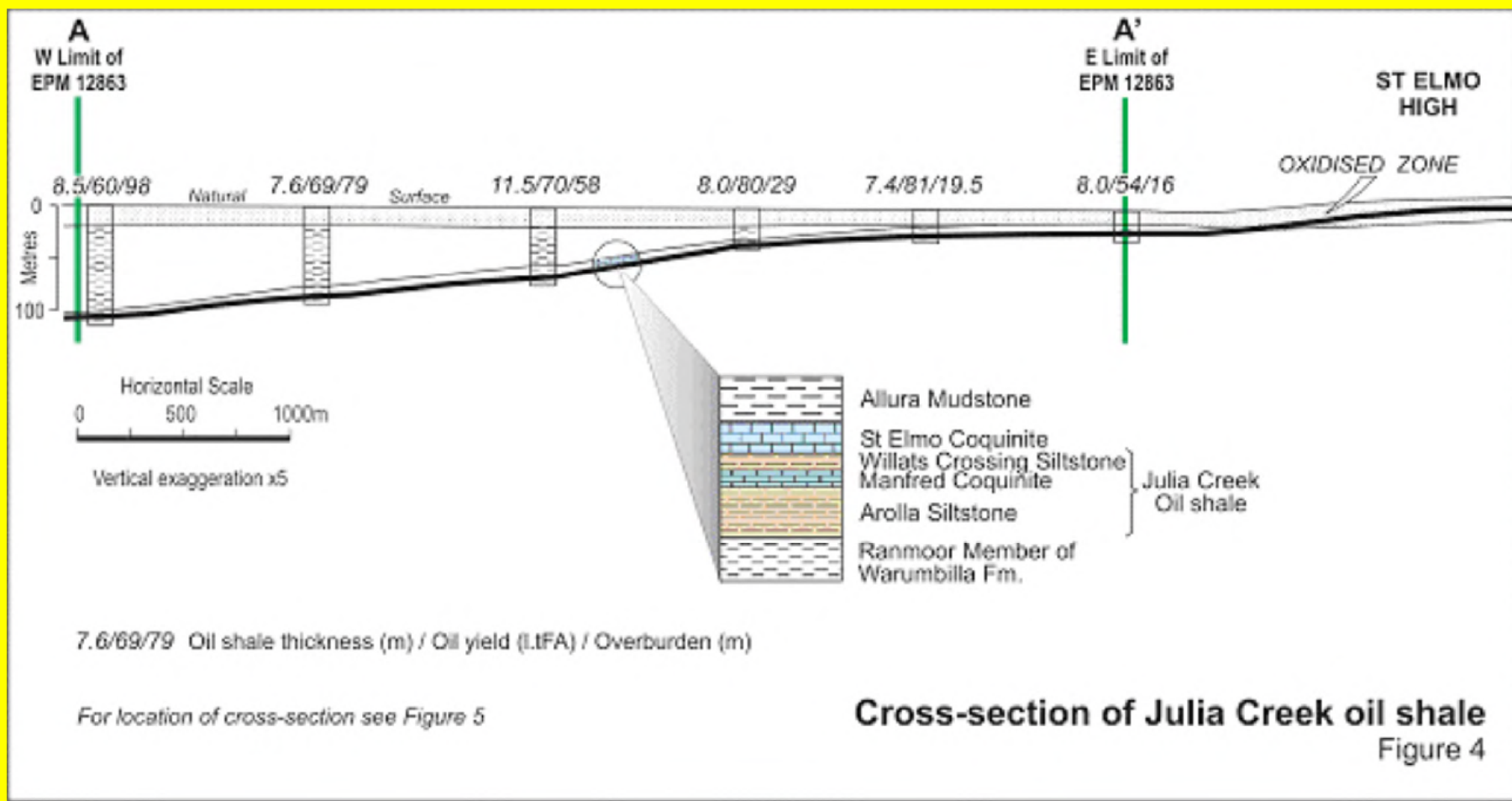


Toolebuc Basin of Preservation





Toolebuc was deposited during a 2 million year Albian marine episode. Apart from uplift & erosion at the margins & post deposition faulting Toolebuc is very uniform.

Eromanga Basin Stratigraphy

Toolebuc Shale

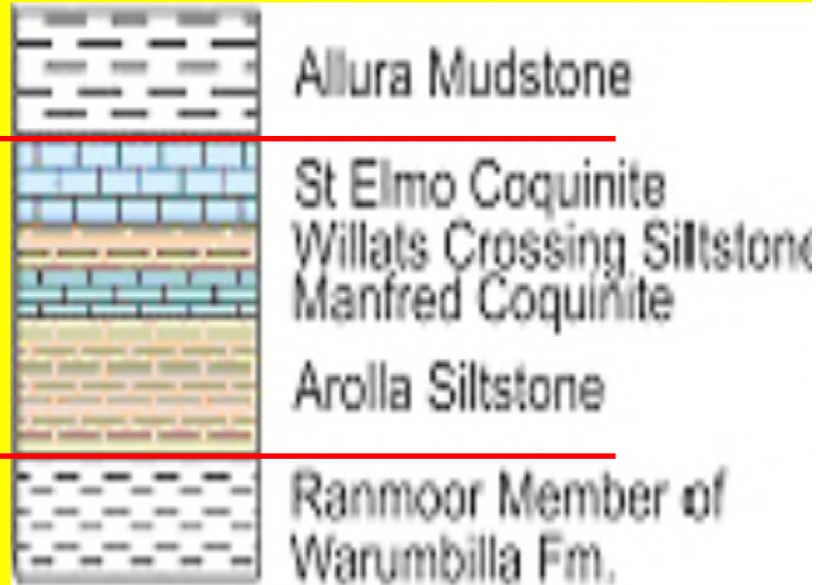
Allaru Shale

Toolebuc

Wallumbilla

AGE	FORMATION AND DOMINANT LITHOLOGY	
RECENT TERTIARY	Surficial deposits alluvium	
Unconformity		
LATE CRETACEOUS	ROLLING DOWNS GROUP	Winton Formation Shale, siltstone
		Mackunda Formation Siltstone, sandstone, minor shale
Allaru Mudstone Shale, minor siltstone, sandstone		
Toolebuc Formation Siltstone, marl		
Wallumbilla Formation Shale, minor sandstone		
Cadna-Owie Formation Shale, minor sandstone		
Hooray Sandstone Sandstone, minor shale		
Murta Fm sandstone+shale		
Namur Fm sandy shale/ss, minor shale		
EARLY CRETACEOUS	Westbourne Formation Shale, siltstone/sandstone	
	Adori Sandstone sandstone	
EARLY TO MIDDLE JURASSIC	Birkhead Formation Shale, siltstone, coal	
	Hutton Sandstone Sandstone, minor shale	

Toolebuc Uppermost Albian



Condensed Section
at Julia Creek
weathered & unlike
subsurface

Allura Mudstone Blue-grey shale;
some basal shells – grades into St
Elmo Coquinite

St Elmo Coquinite – up to 8 m of
shell limestone

Willat's Crossing Limestone – up
to 4 m of bituminous siltstone

Manfred Coquinite – up to 2-3 m of
shell limestone, with interbeds of
bituminous siltstone

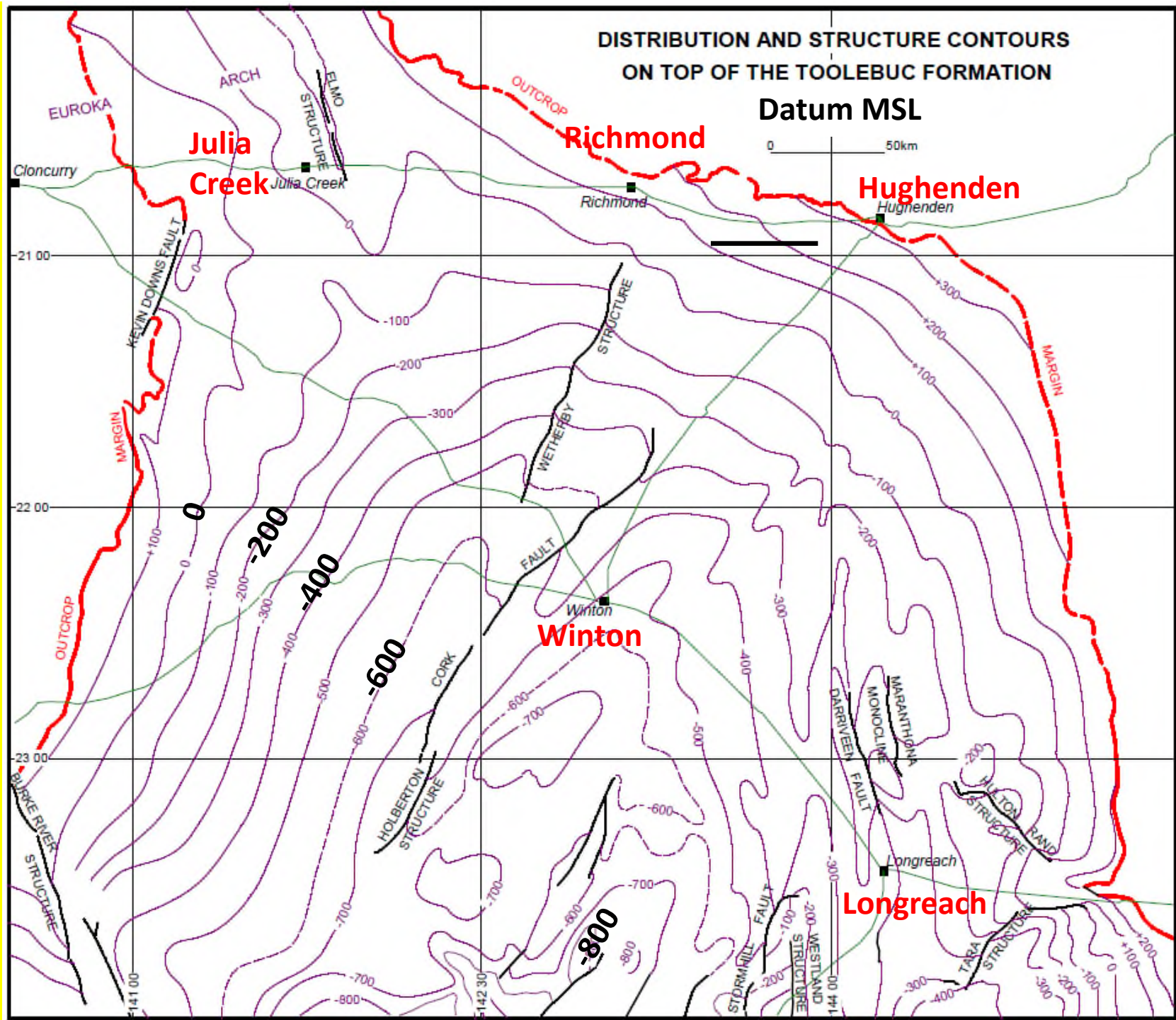
Arolla Siltstone – up to 12 m of
bituminous siltstone

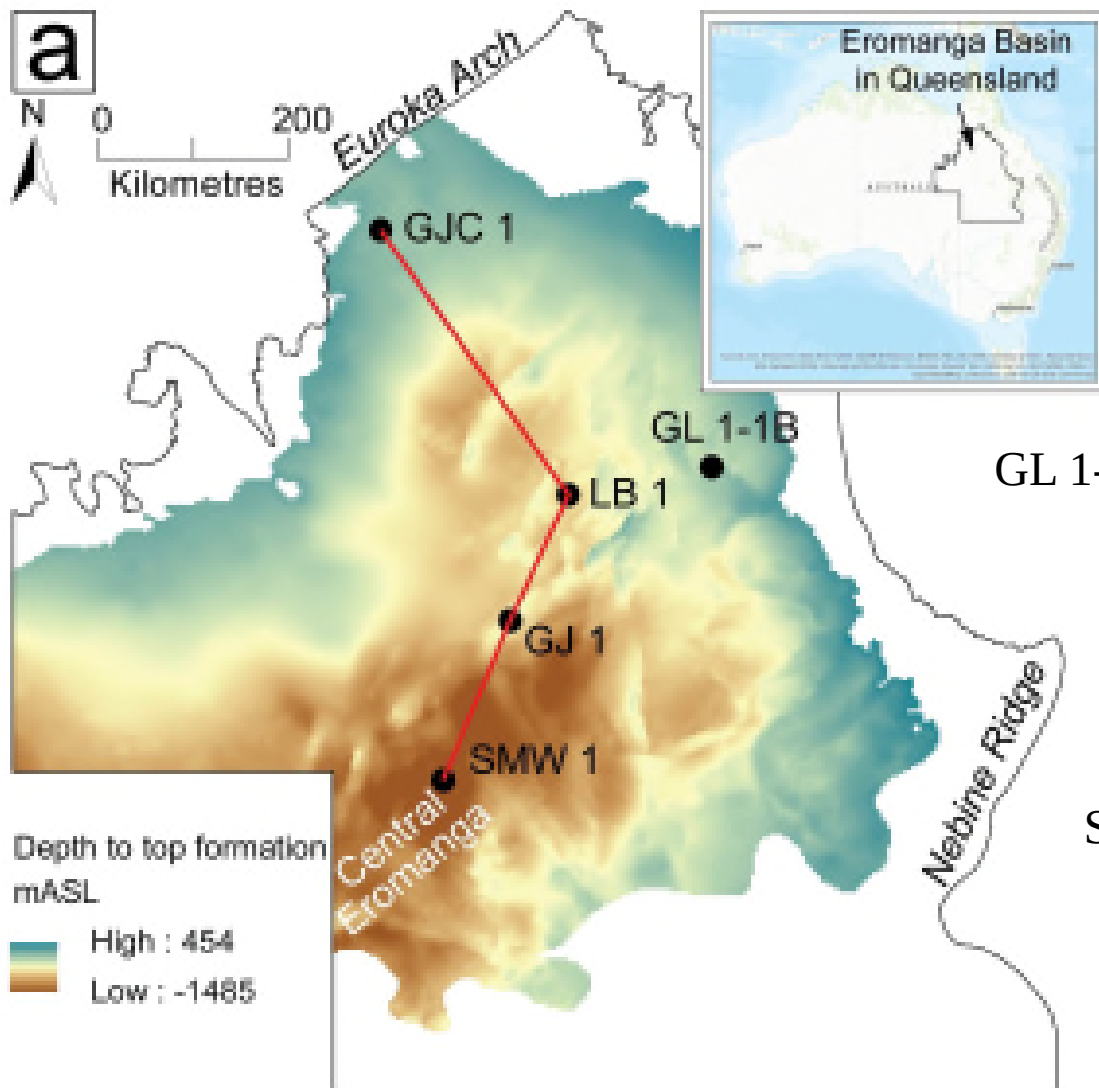
Ranmoor Member of the Walumbilla
Formation Grey shale

DISTRIBUTION AND STRUCTURE CONTOURS
ON TOP OF THE TOOLEBUC FORMATION

Datum MSL

0 50km





GJC 1: GSQ **Julia Creek 1**

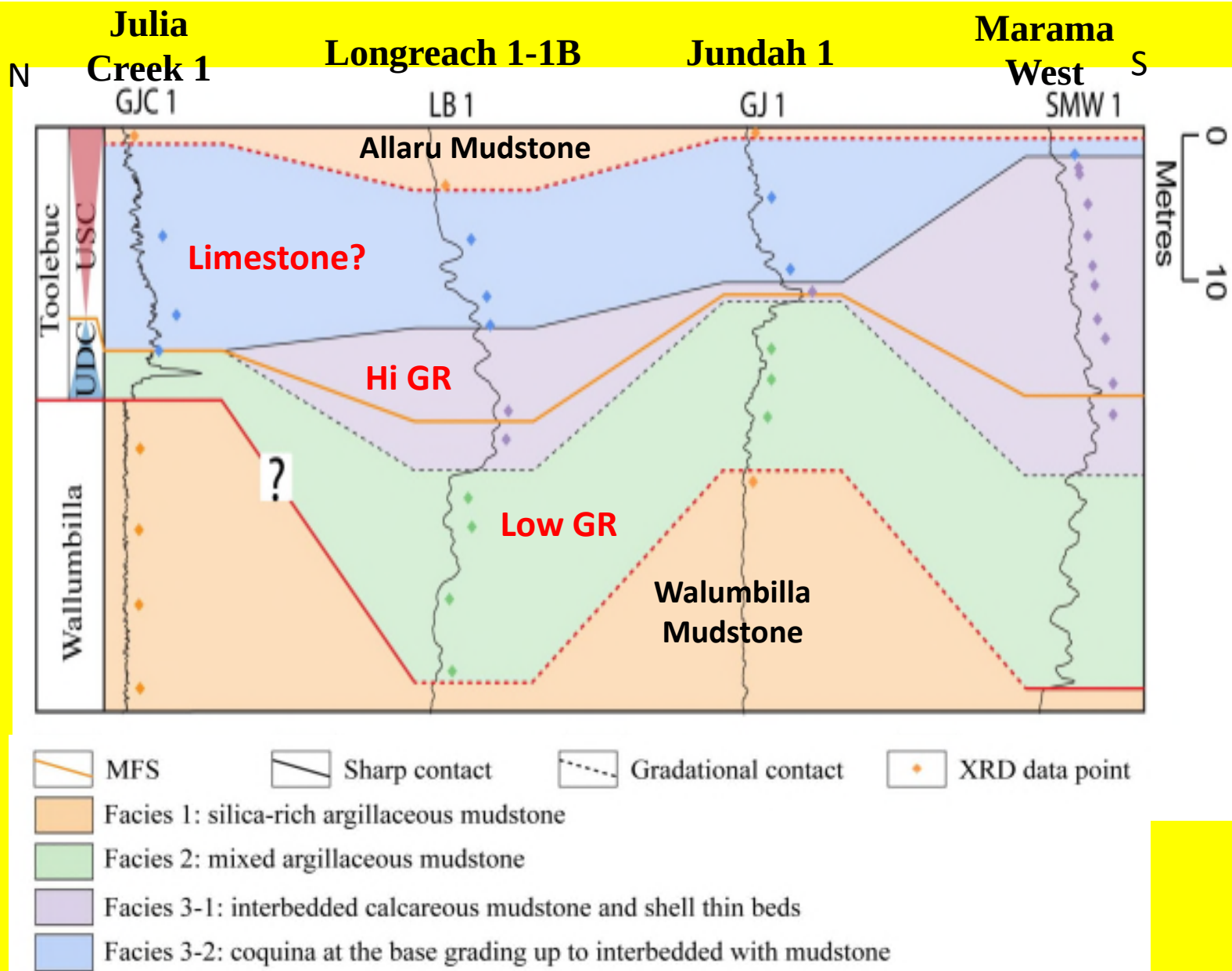
GL 1-1B: GSQ **Longreach 1-1B**

GJ 1: GSQ **Jundah 1**

SMW 1: SSL **Marama West**

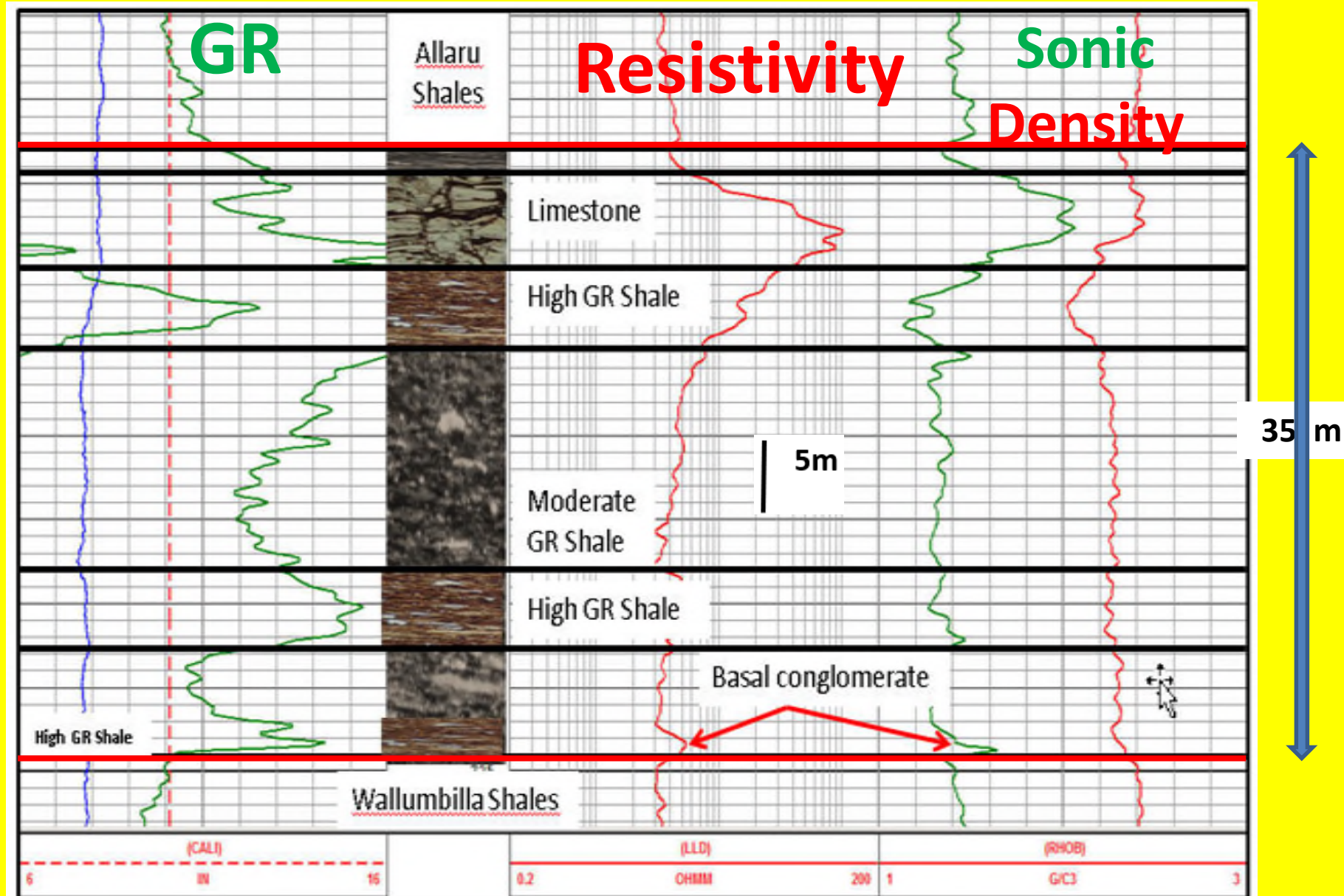
Reservoir lithofacies study of the Toolebuc Formation, Eromanga Basin, Australia as an unconventional target

Xiaoxiao Mao*, Sandra Rodrigues, Joan S. Esterlea, Suzanne D. Golding a School of Earth and Environmental Sciences, The University of Queensland, QLD 4072, Australia



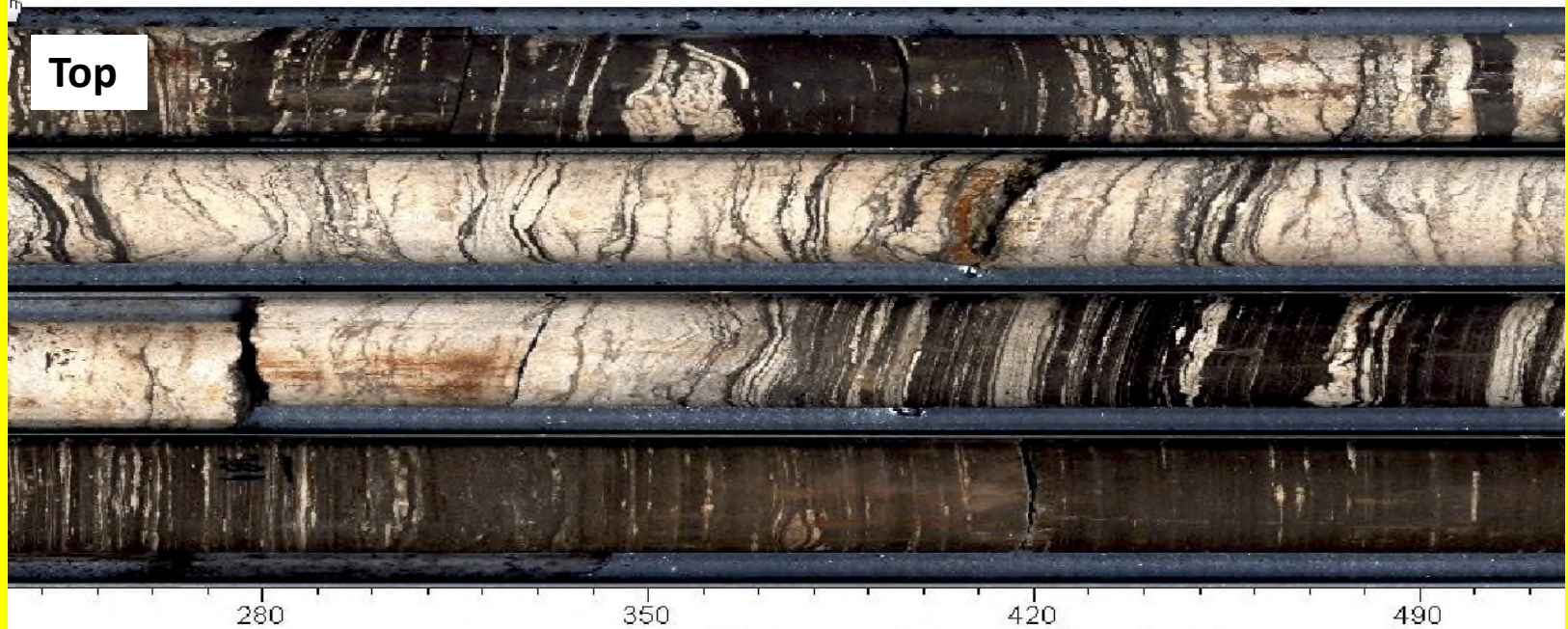
A Structural-Stratigraphic Misinterpretation

Bimmerah 1: 40m 'Type Section' of Toolebuc

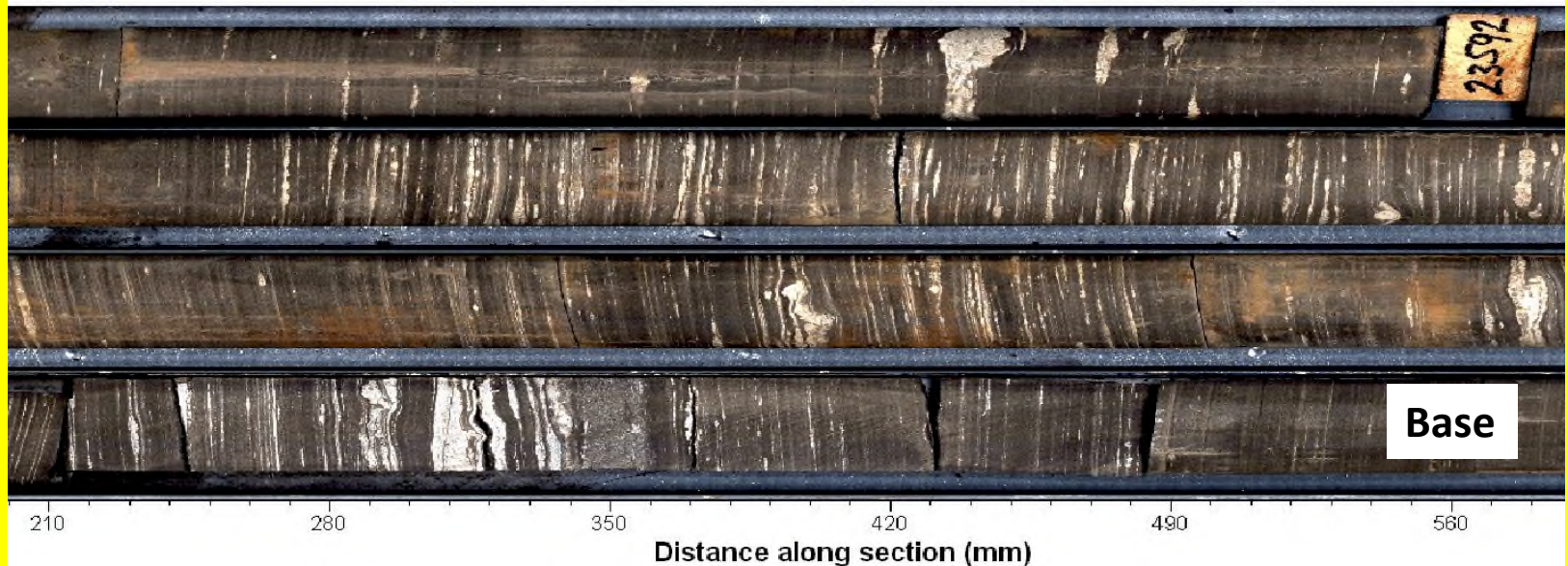


GSQ - Dobbyn1 Tray 117, 381.4 to 384.5 m

Top



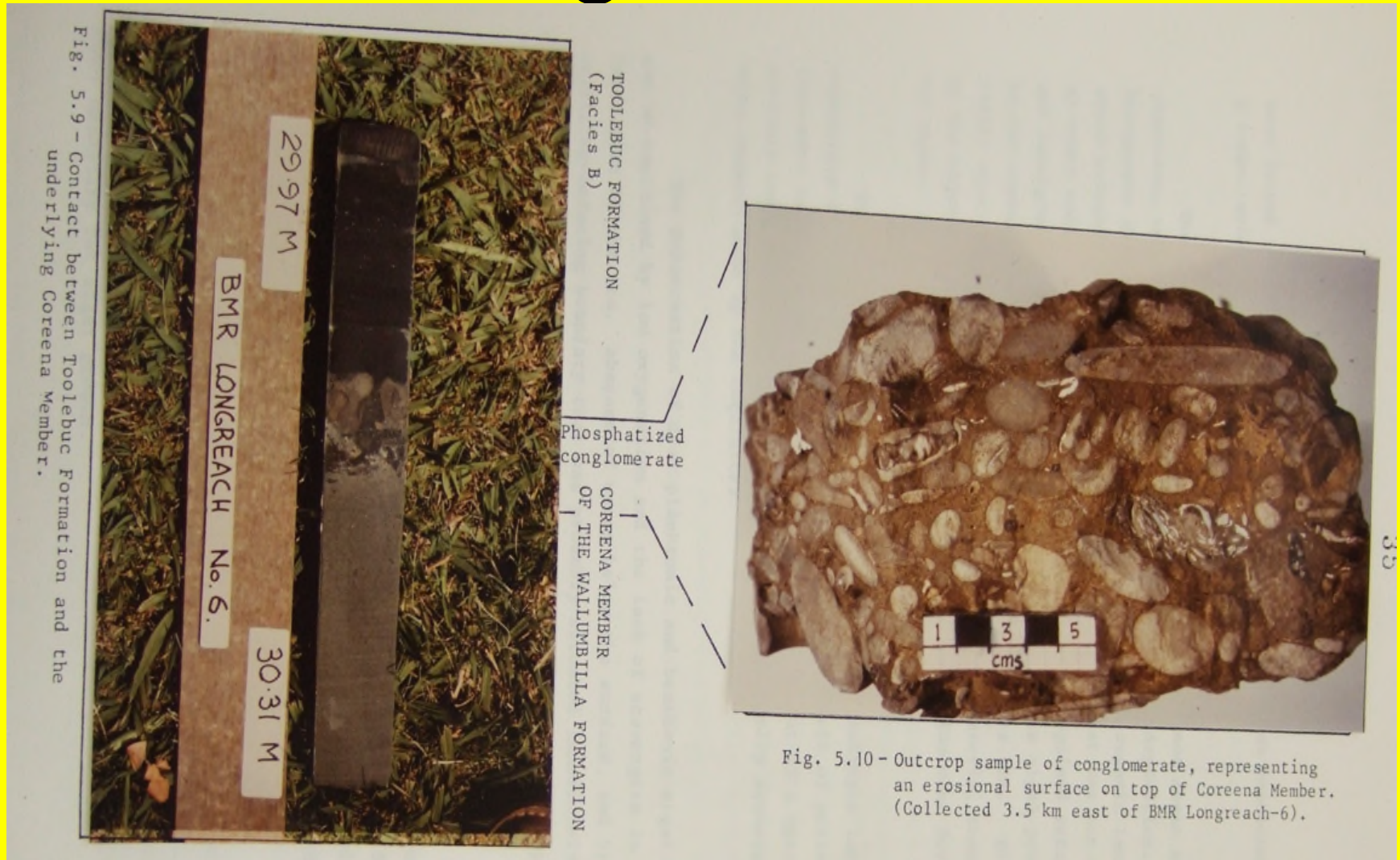
GSQ - Dobbyn1 Tray 118, 384.5 to 387.6 m



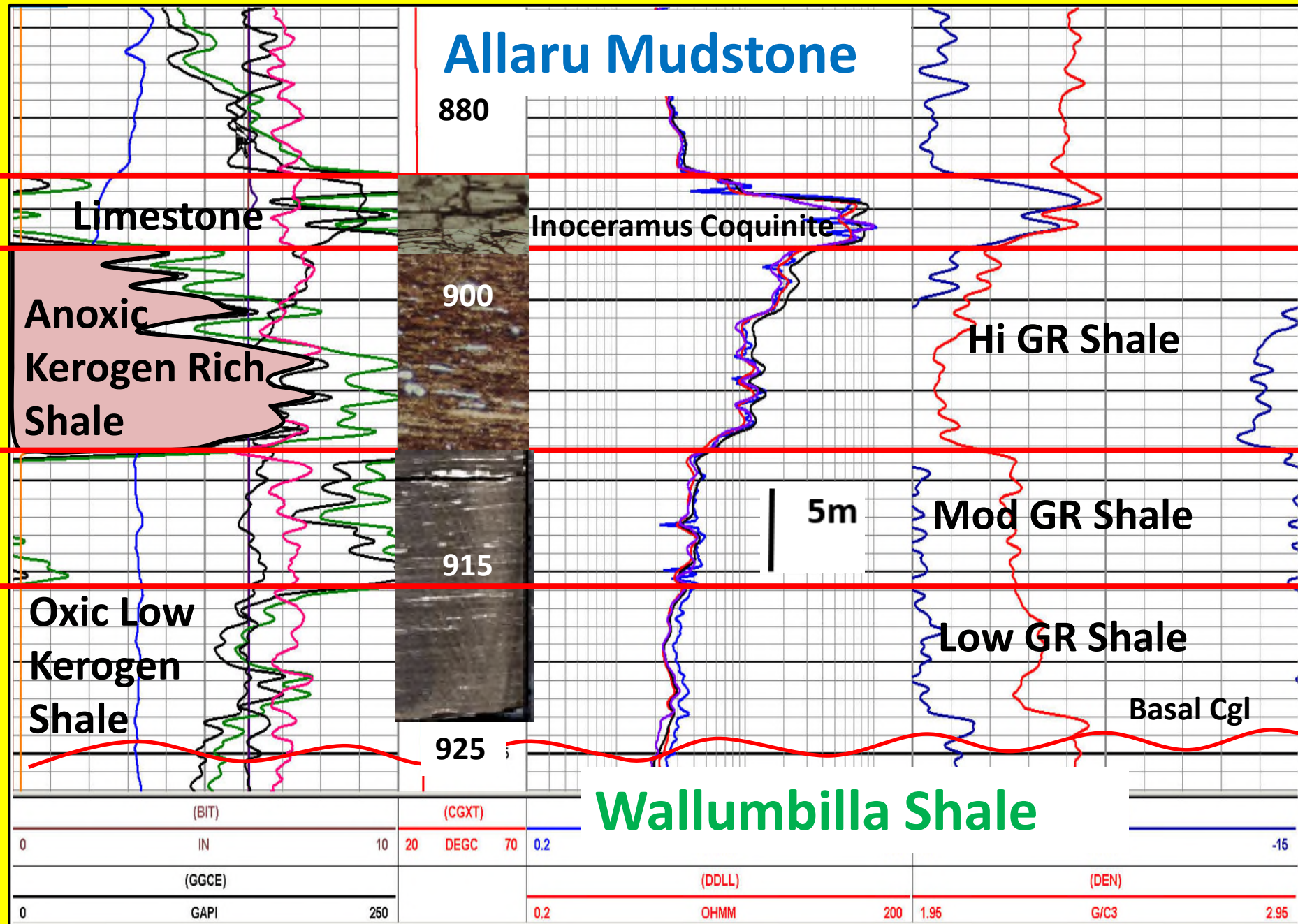


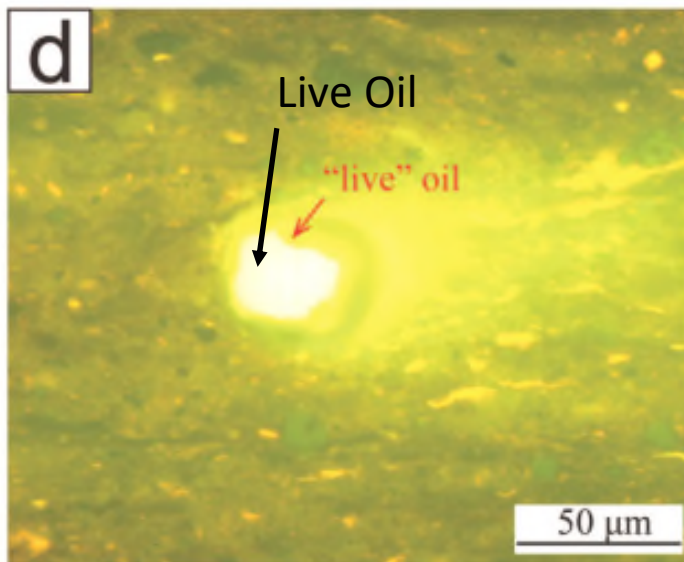
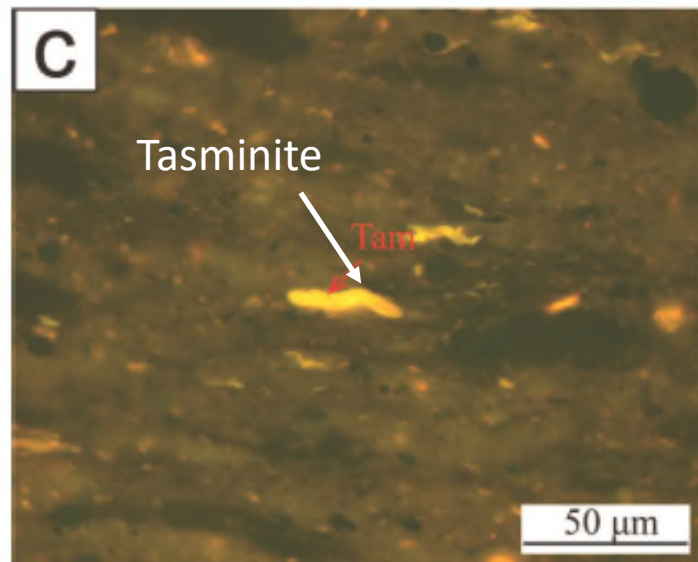
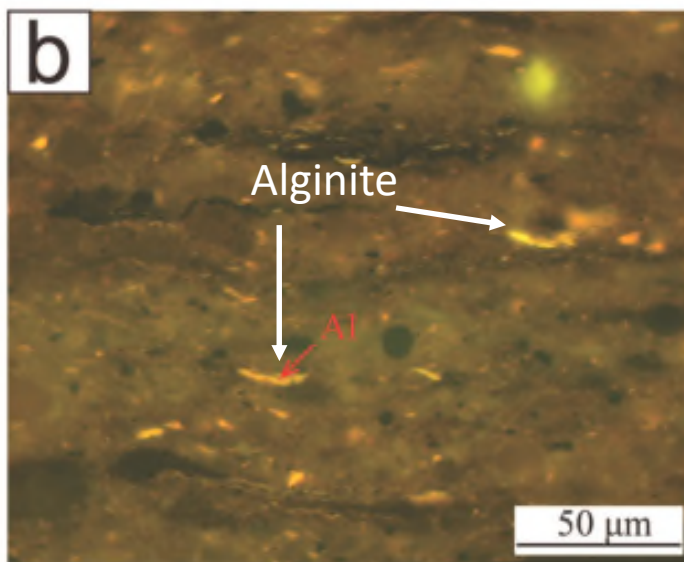
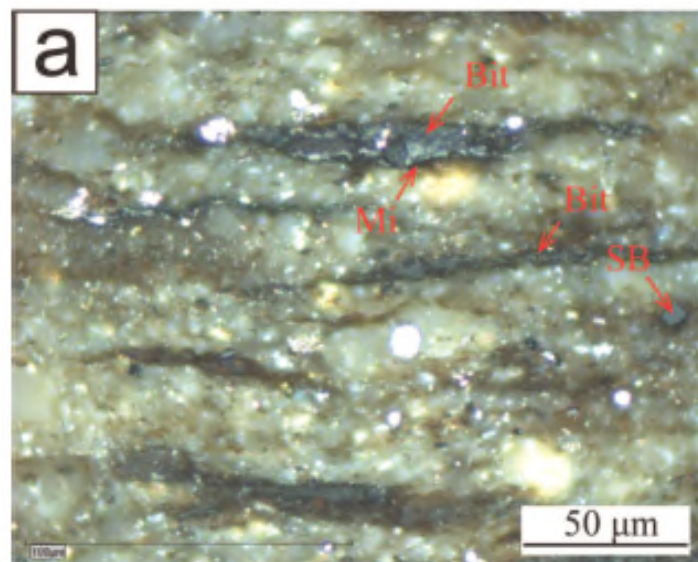
Listric Faults &
Microfractures in
Toolebuc Limestone

Basal Toolebuc Unconformity Longreach 6



30m Toolebuc Facies 893 – 909m





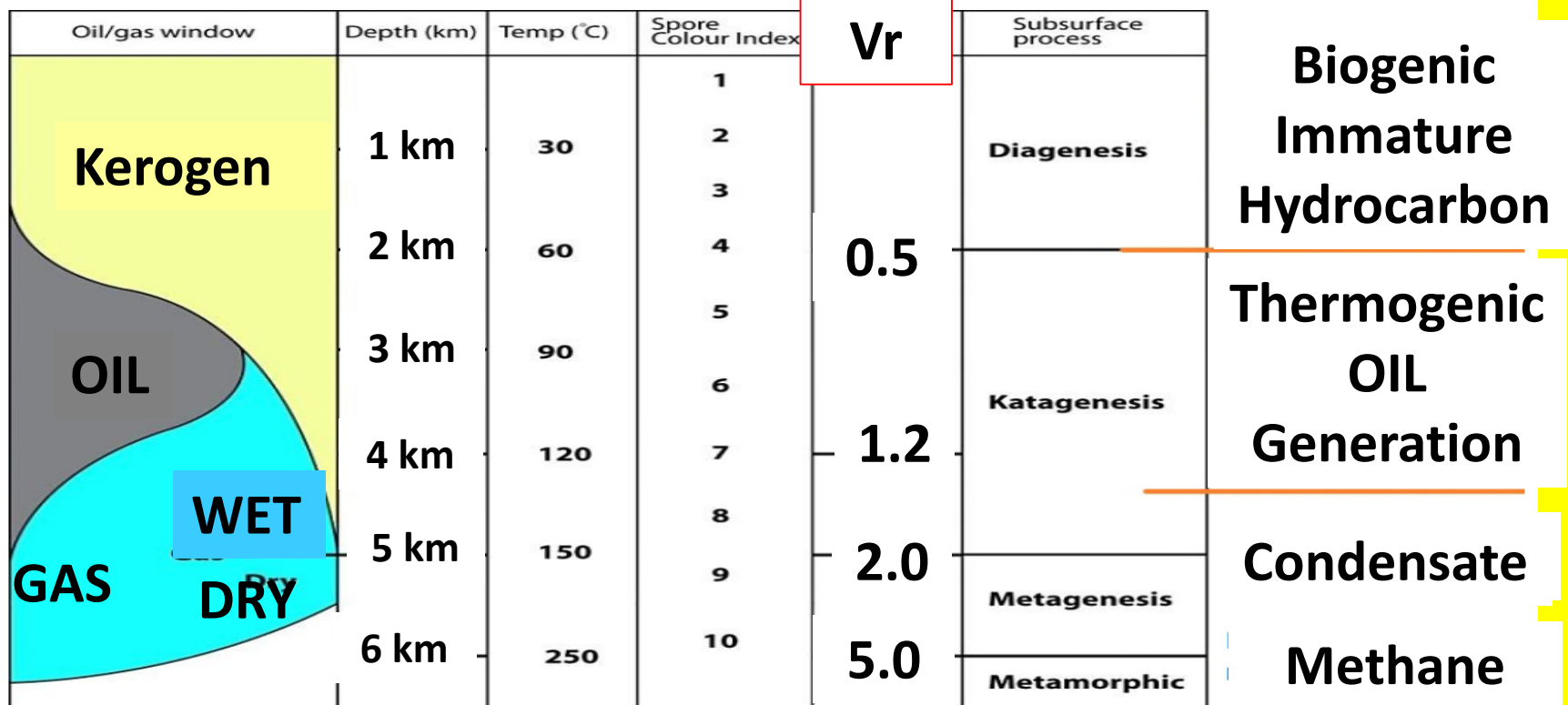
**Oil & Gas are generated in organic rich sediments
and escapes to accumulate in Reservoirs
If it does not escape it becomes**

Oil Shale produces oil by
retorting at the surface

Shale Oil is existing/trapped oil that cannot escape
and is produced from subsurface by fracking

Preserved organic material produces oil & gas as it is buried and heated, and porosity changes

Biogenic gas & oil at shallow depths
Thermogenic oil & gas at depth

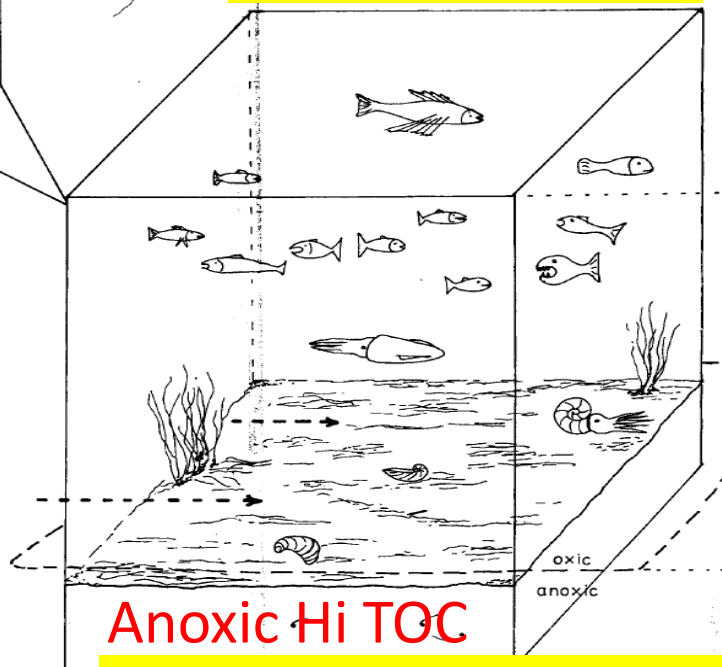


Organic Maturity from Vitrinite Reflectance (Vr)

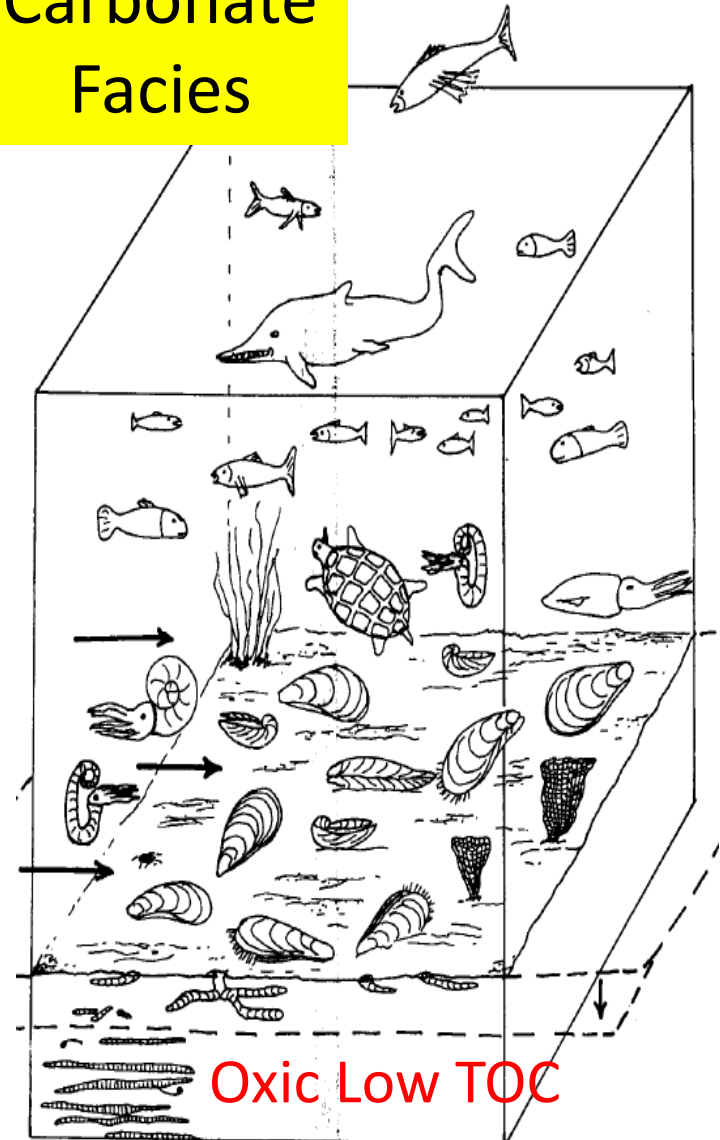
Toolebuc Organic Facies

Anoxic
Kerogen Rich
Facies
Black Sea

Plankton



Carbonate Facies



TOC = Total Organic Content

Pyrolysis: Total Organic Matter (TOC)

Sample crushed and heated slowly

S1 peak = Existing oil evaporated

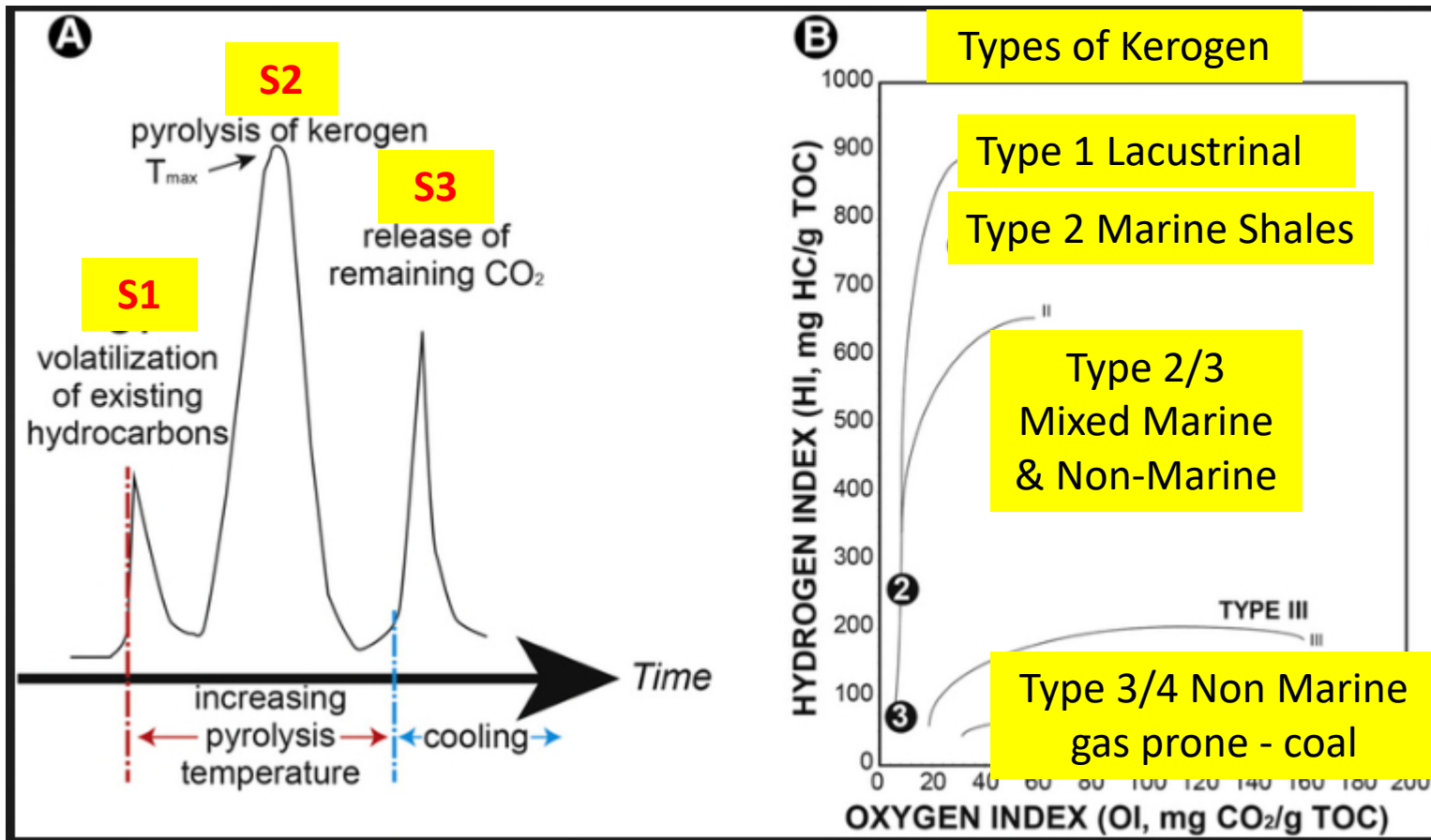
S2 Peak = Potential Oil & Gas expelled from Kerogen

S3 Peak = CO₂ driven off

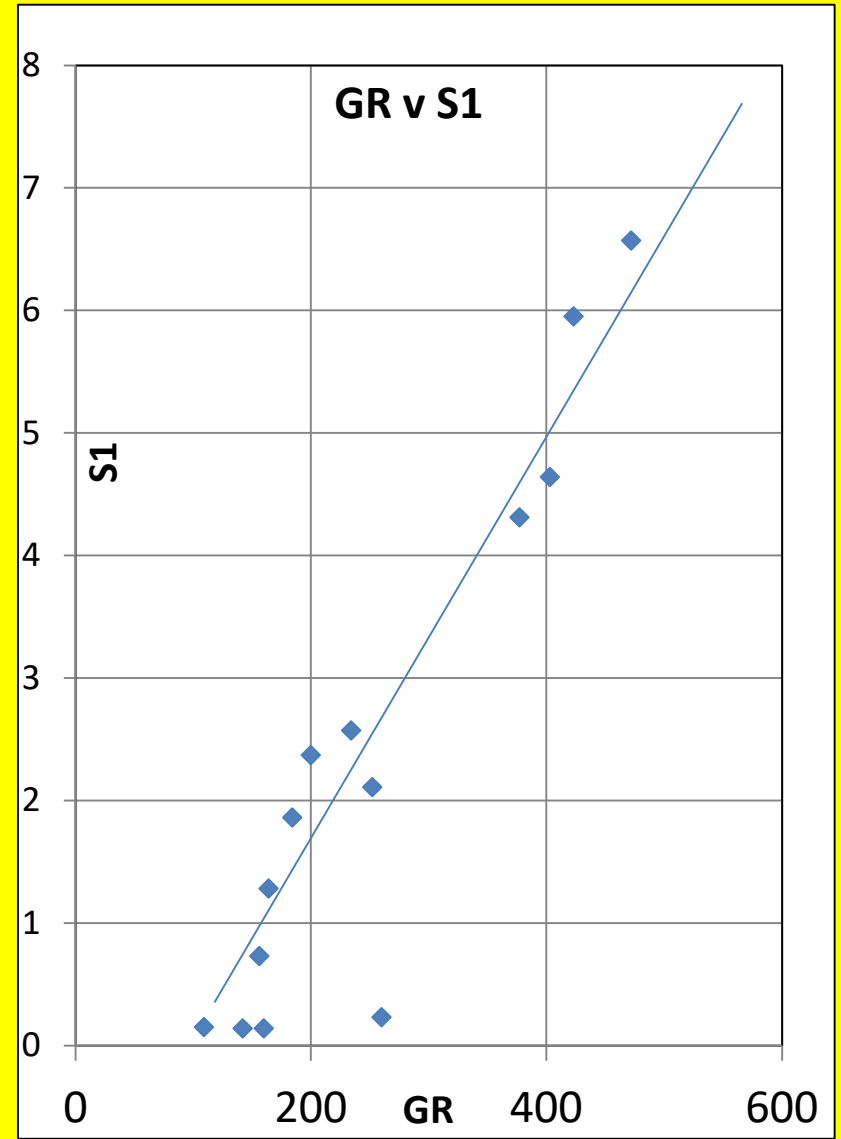
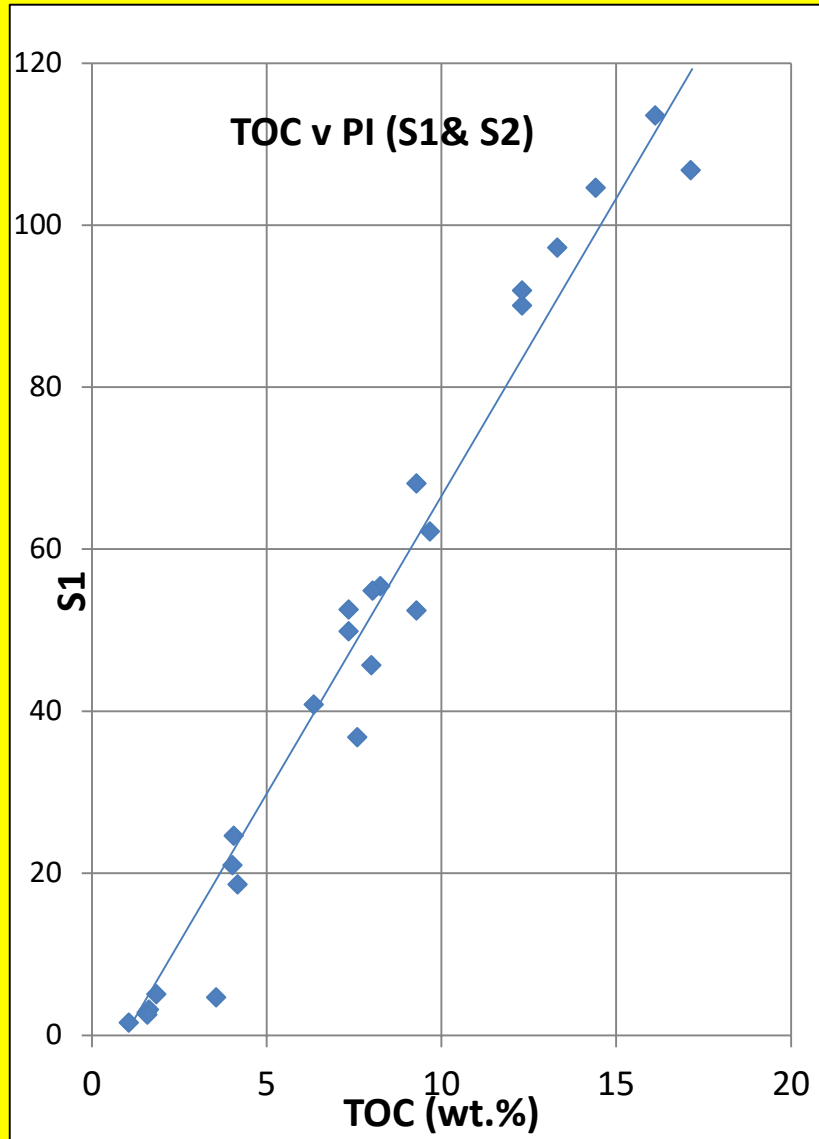
T_{MAX} and
Hydrogen
Index (HI)

$HI = S2/TOC$

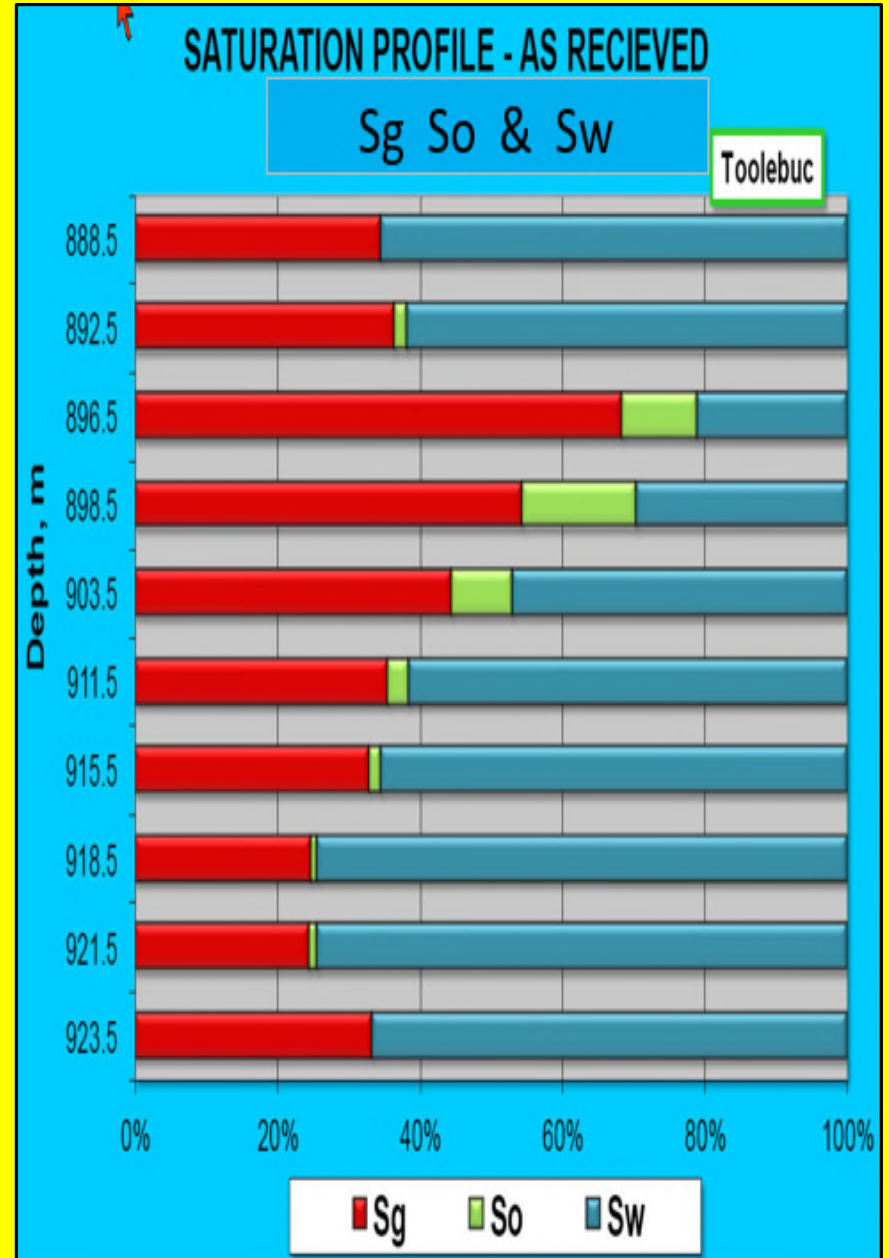
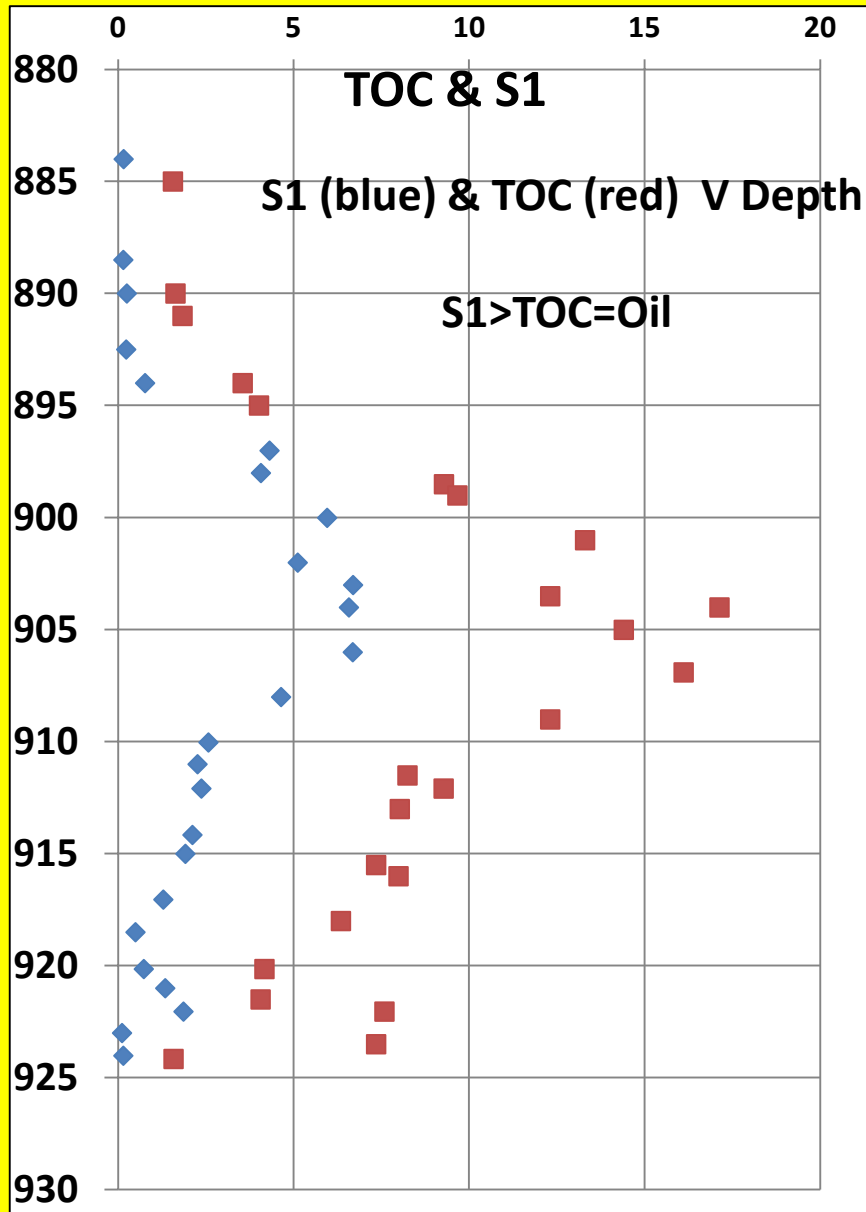
$OI = S3/TOC$

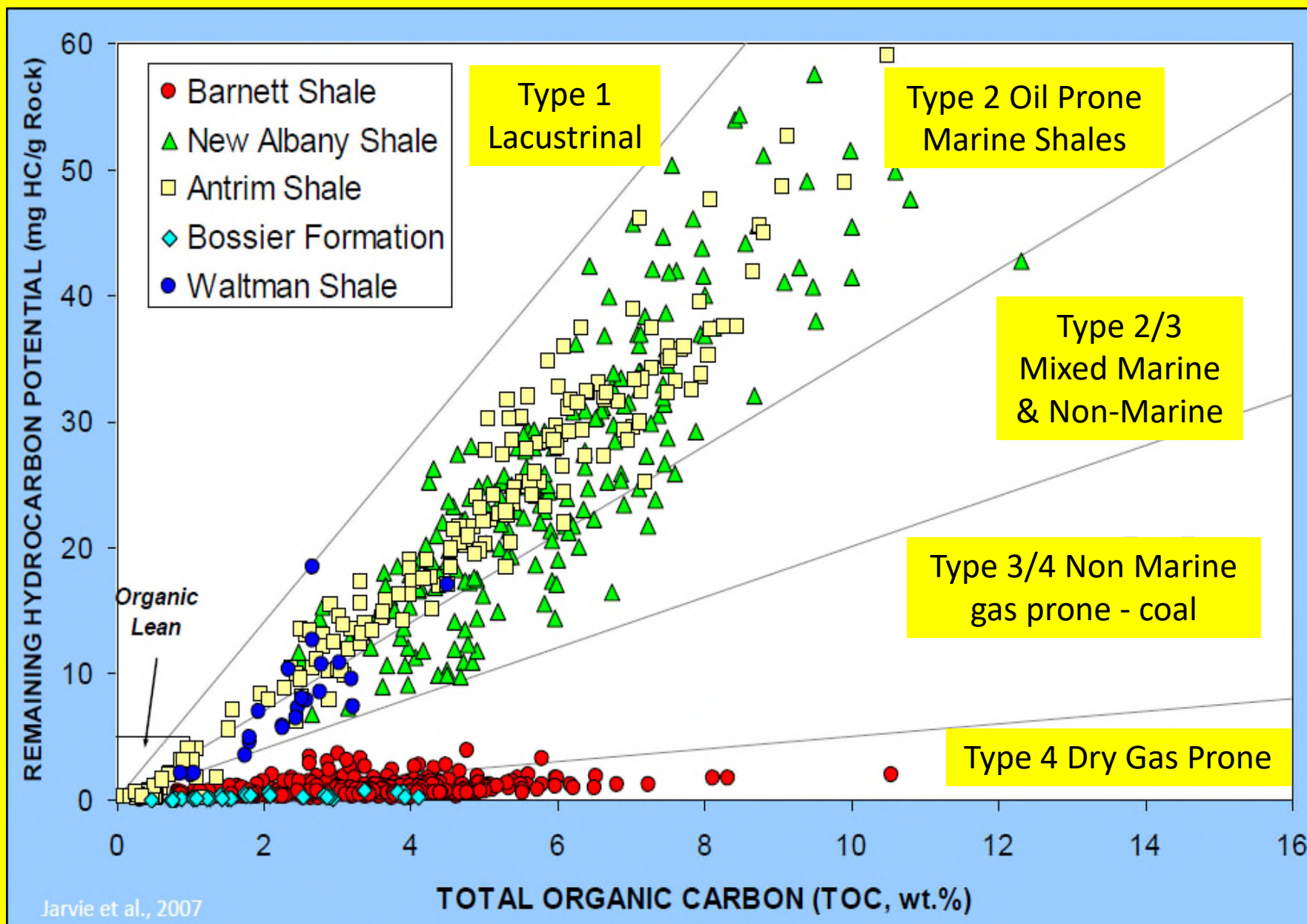


Typical Toolebuc Pyrolysis Data

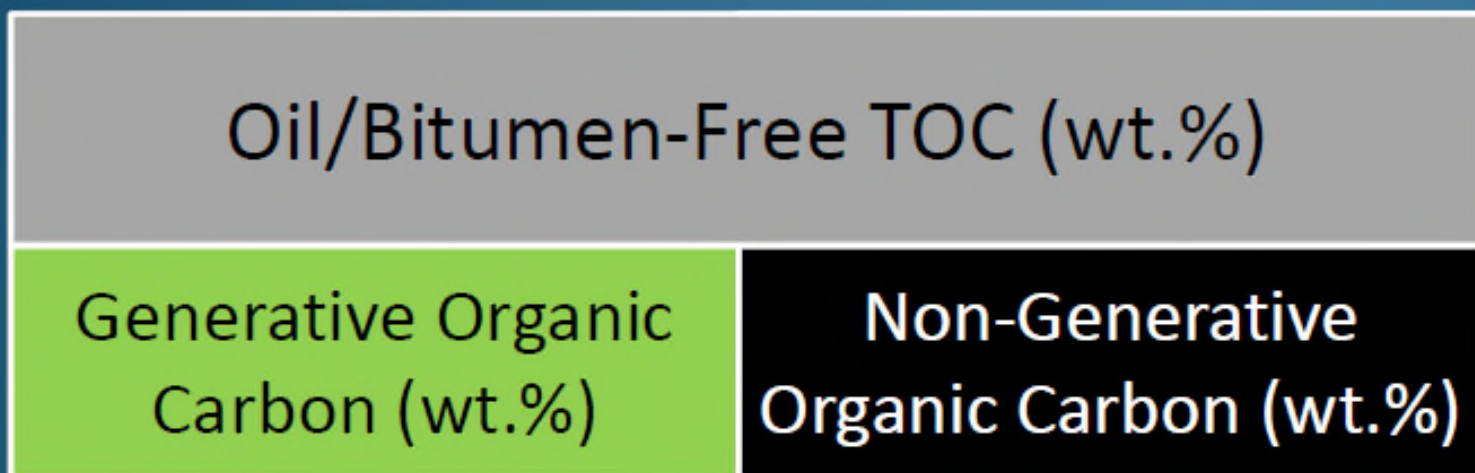


Typical Toolebuc Pyrolysis Data





Diagrammatic Illustration of TOC for a given kerogen type, e.g., Type II

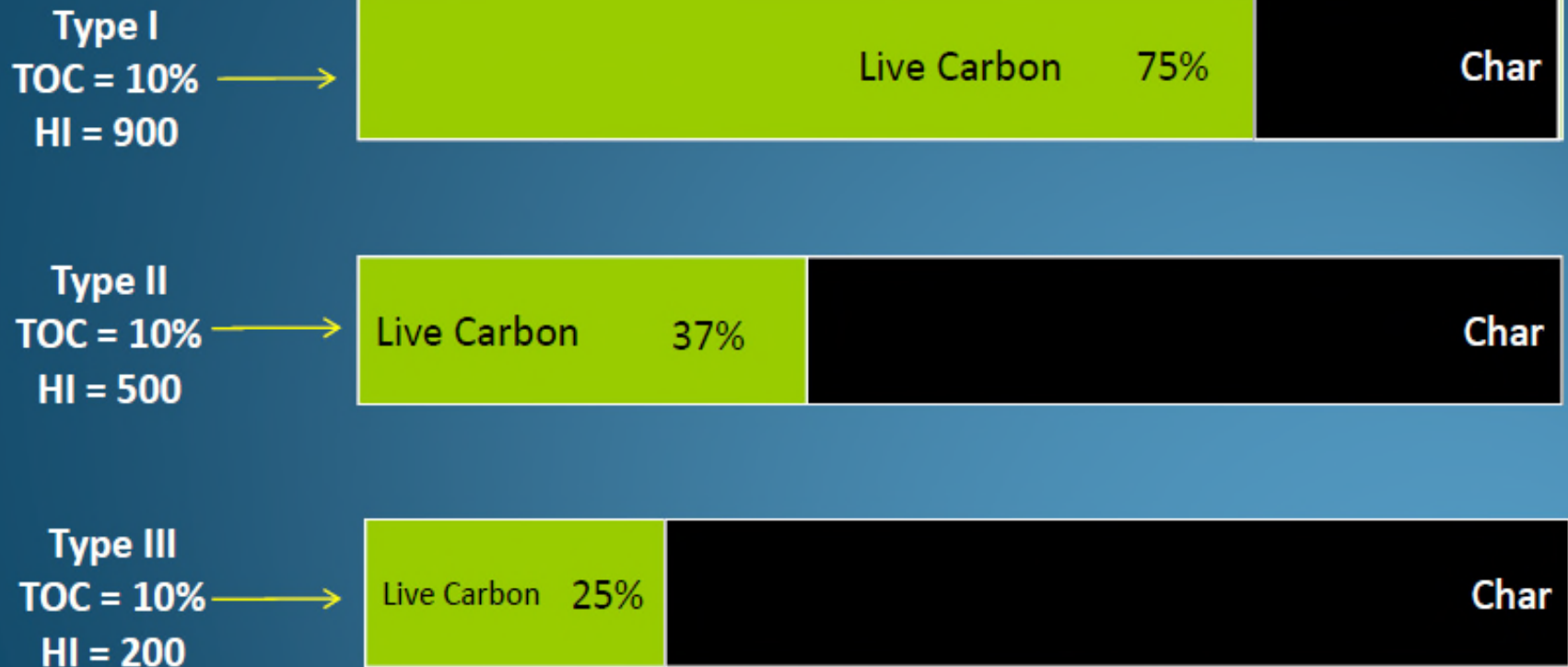


- Responsible for generation of hydrocarbons
- Accounts for development of organic porosity

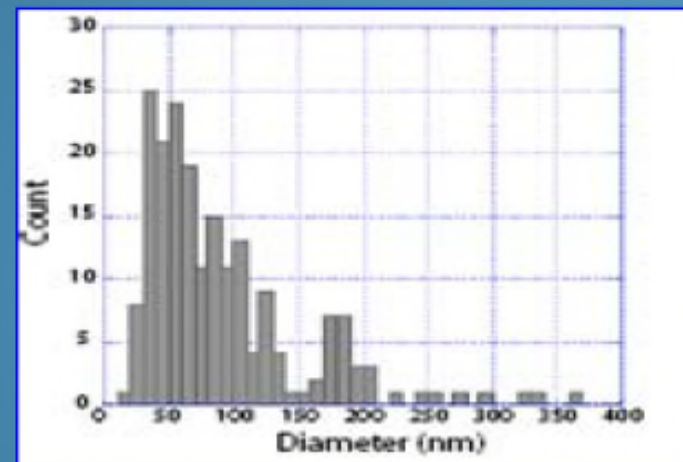
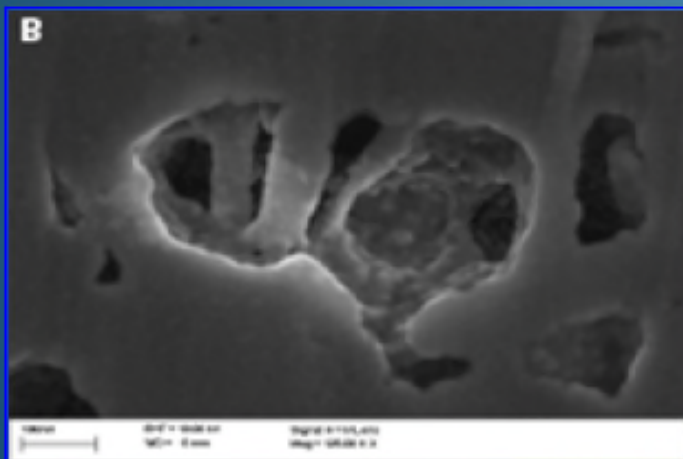
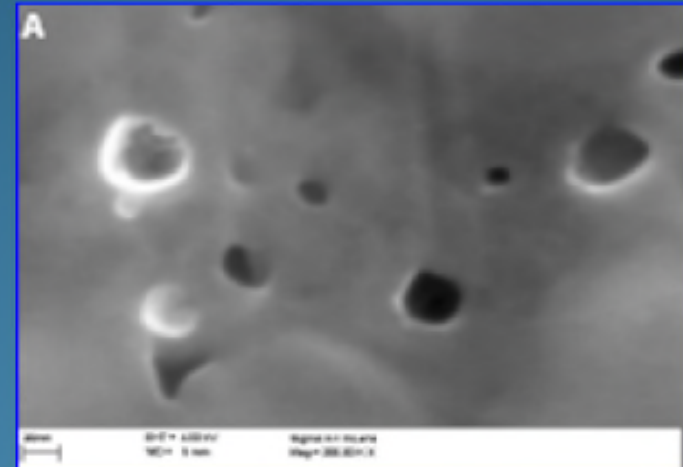
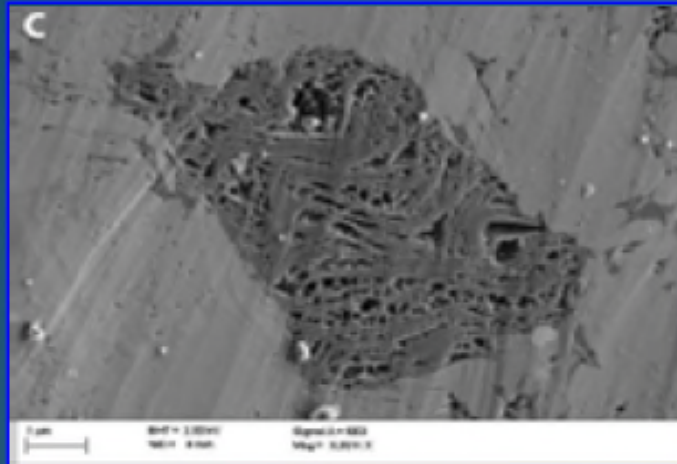
- Does not generate any appreciable amount of petroleum
- Does account for storage by adsorption

TOC Distribution in Various Kerogen Types (in this case with fixed TOC_o)

Examples



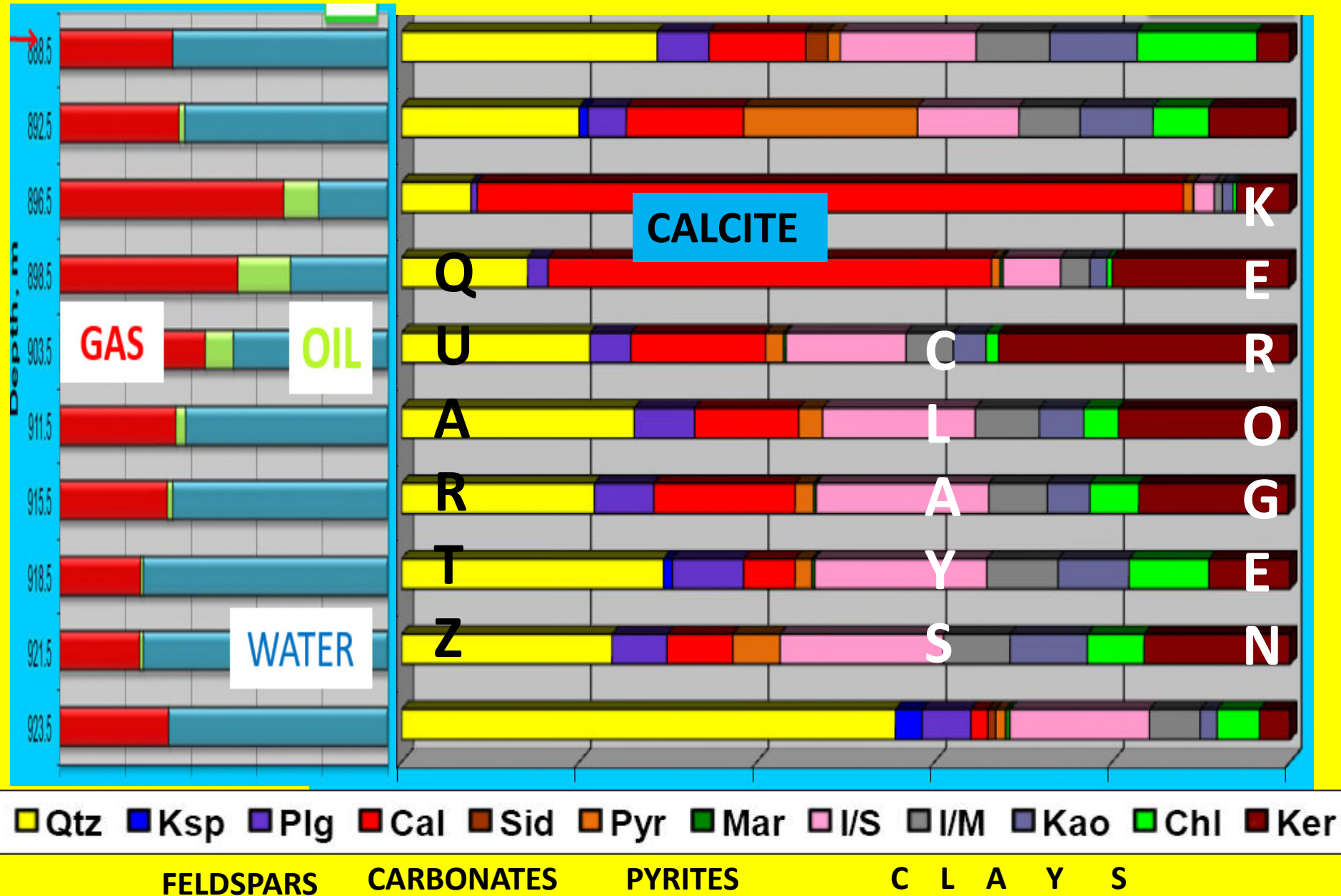
Organic Porosity Development in the Barnett Shale



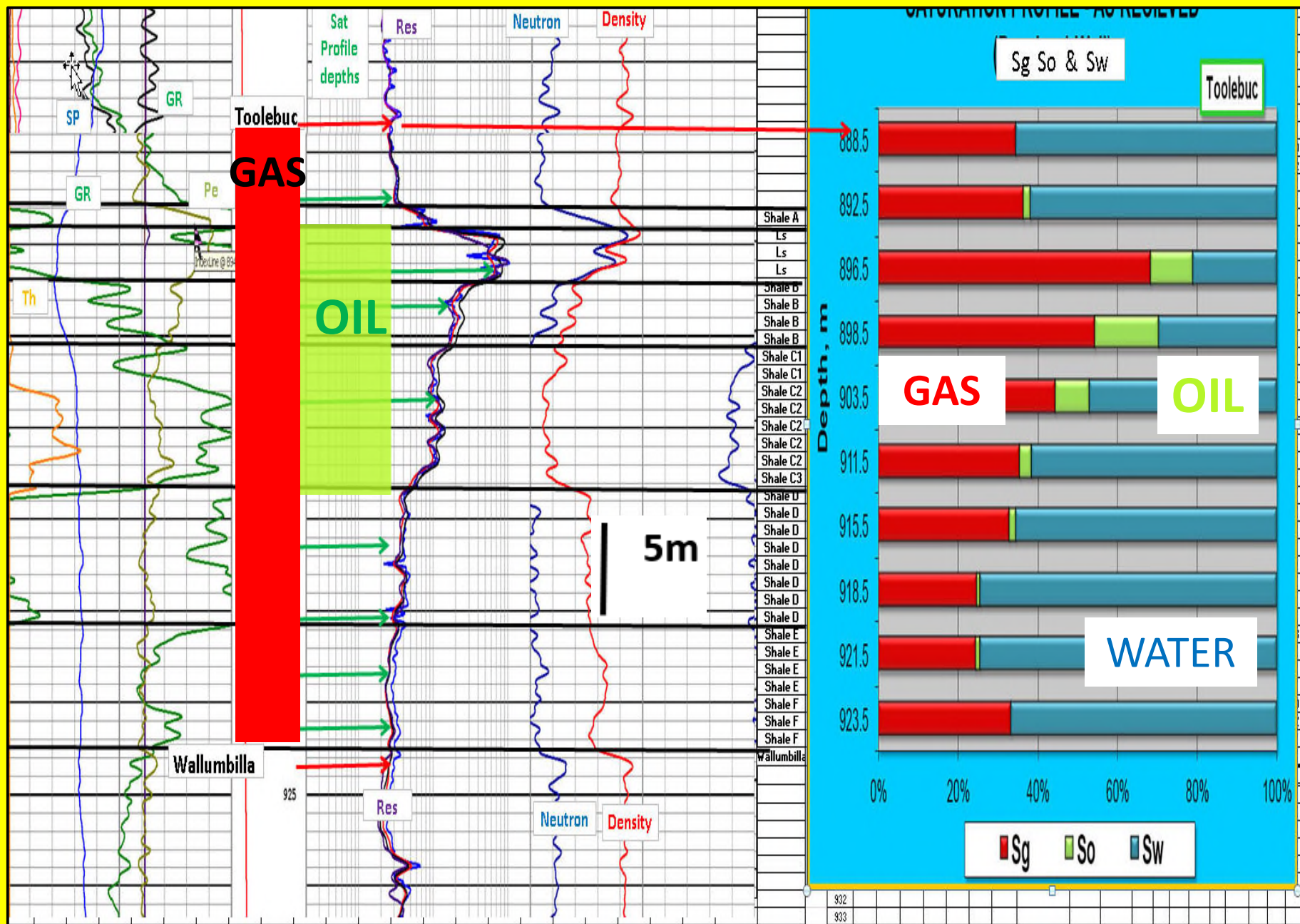
Loucks et al., 2009

Kerogen heated converts to gas & expands creating porosity

Toolebuc Mineralogy by XRD

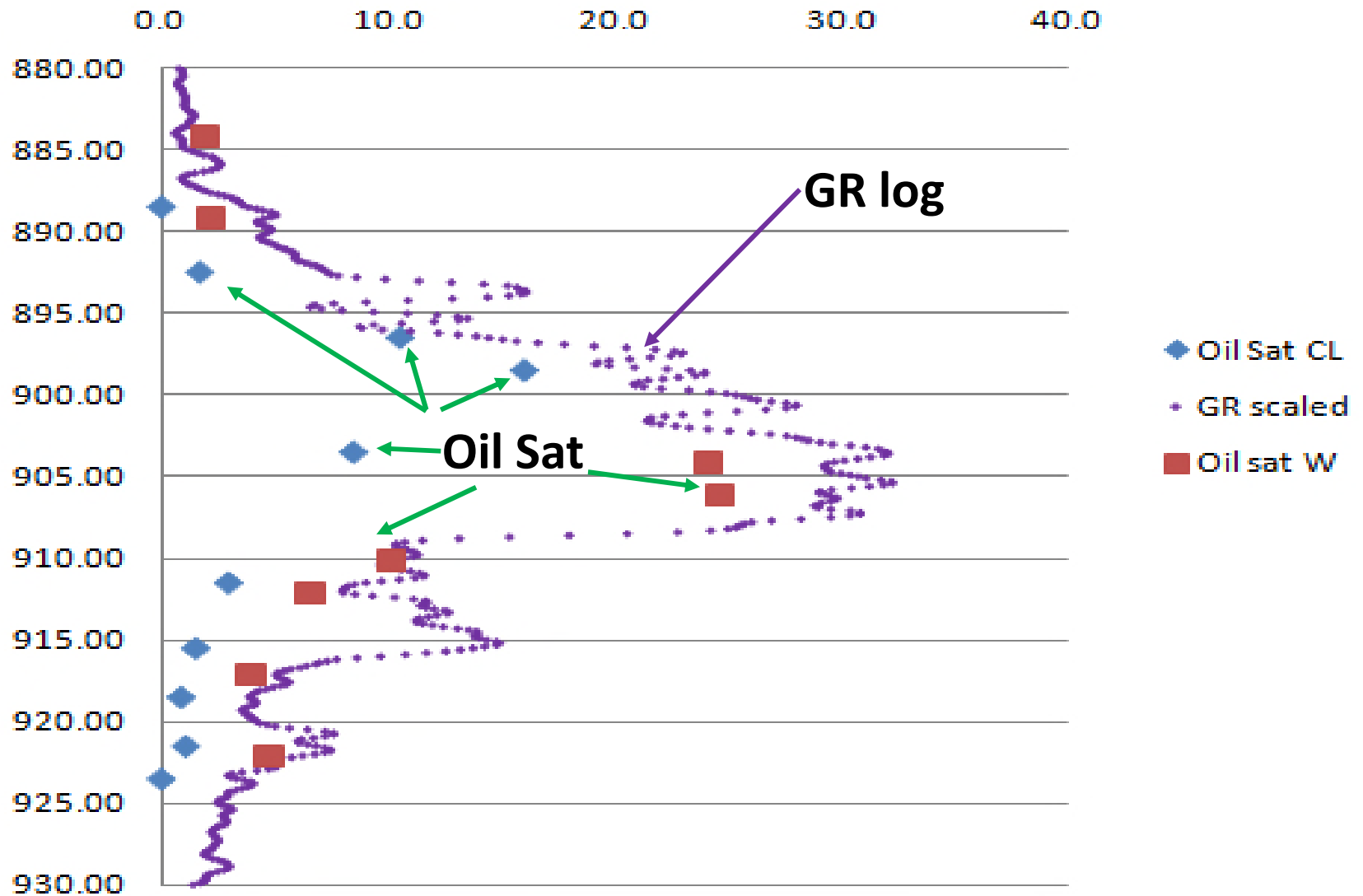


Typical Toolebuc Oil Shale Interval

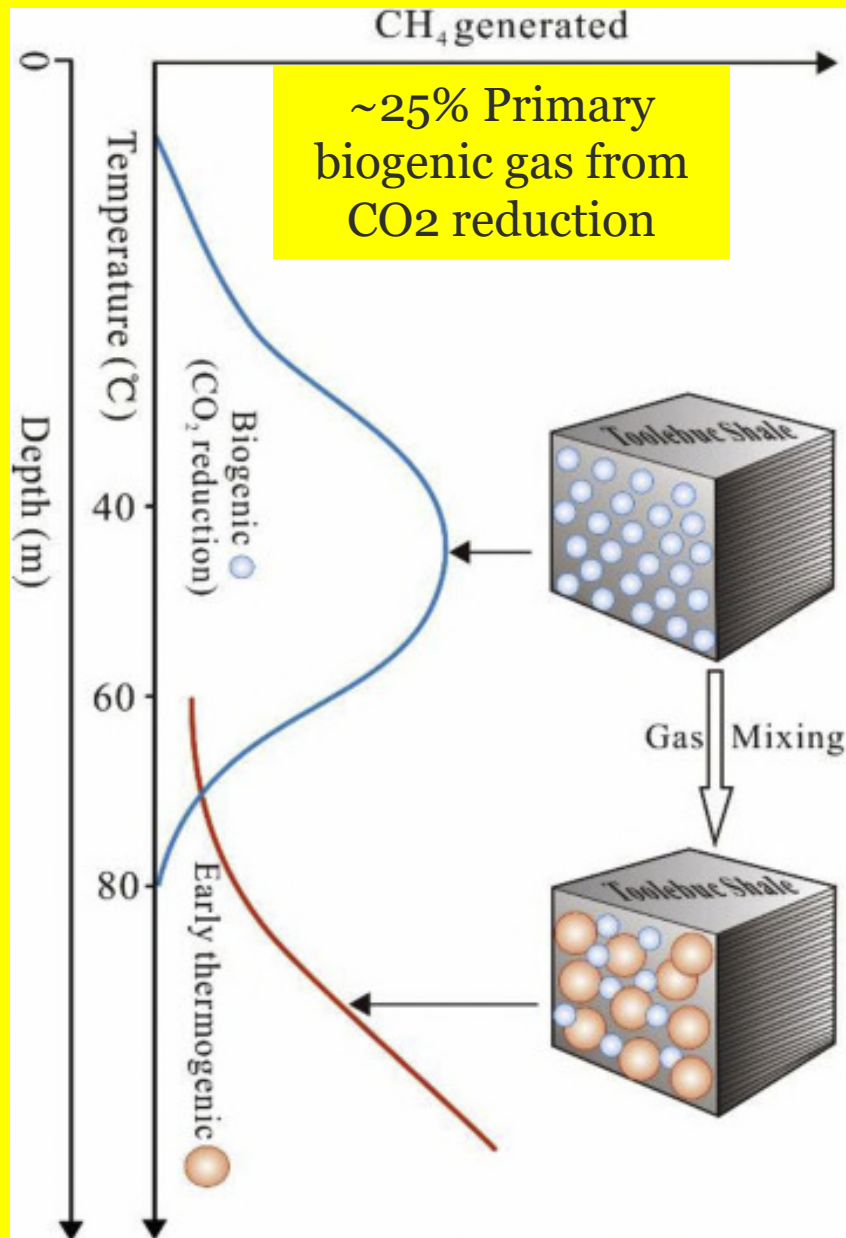


Toolebuc ^{ES}

oil saturation %



Toolebuc Shale Geochemistry



The Toolebuc shales have TOC up to 17% and are primarily enriched in thermally immature Type II organic matter.

Gasses are a mixture of biogenic and early thermogenic gases.

CH_4 (Methane 65%–83%), with minor C_2H_6 (Ethane) and C_3H_8 (Propane)

~75% early thermogenic gas and oil

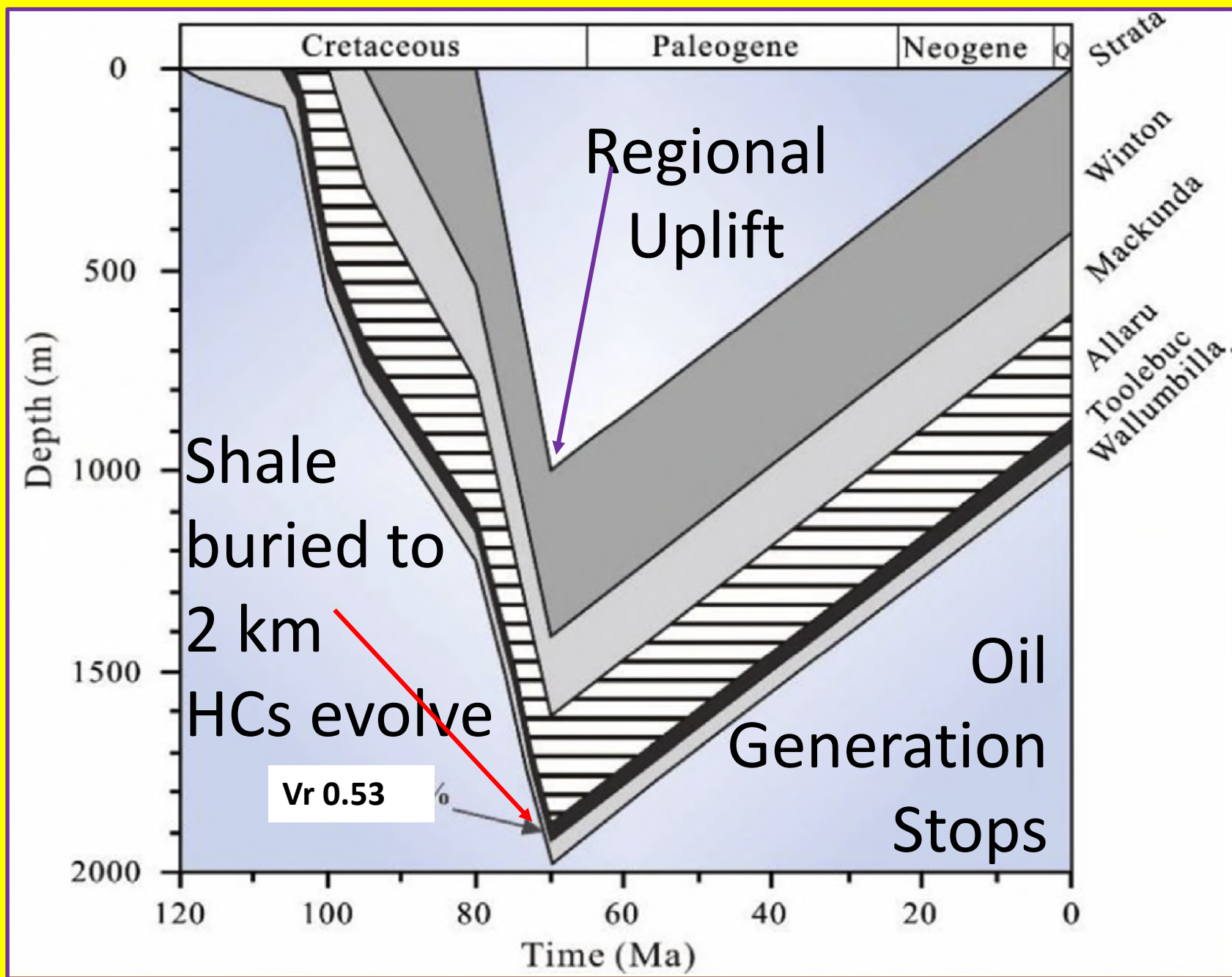
[Watch A Queensland River Catch On Fire
Because Of Fracking \(gizmodo.com.au\)](http://gizmodo.com.au)

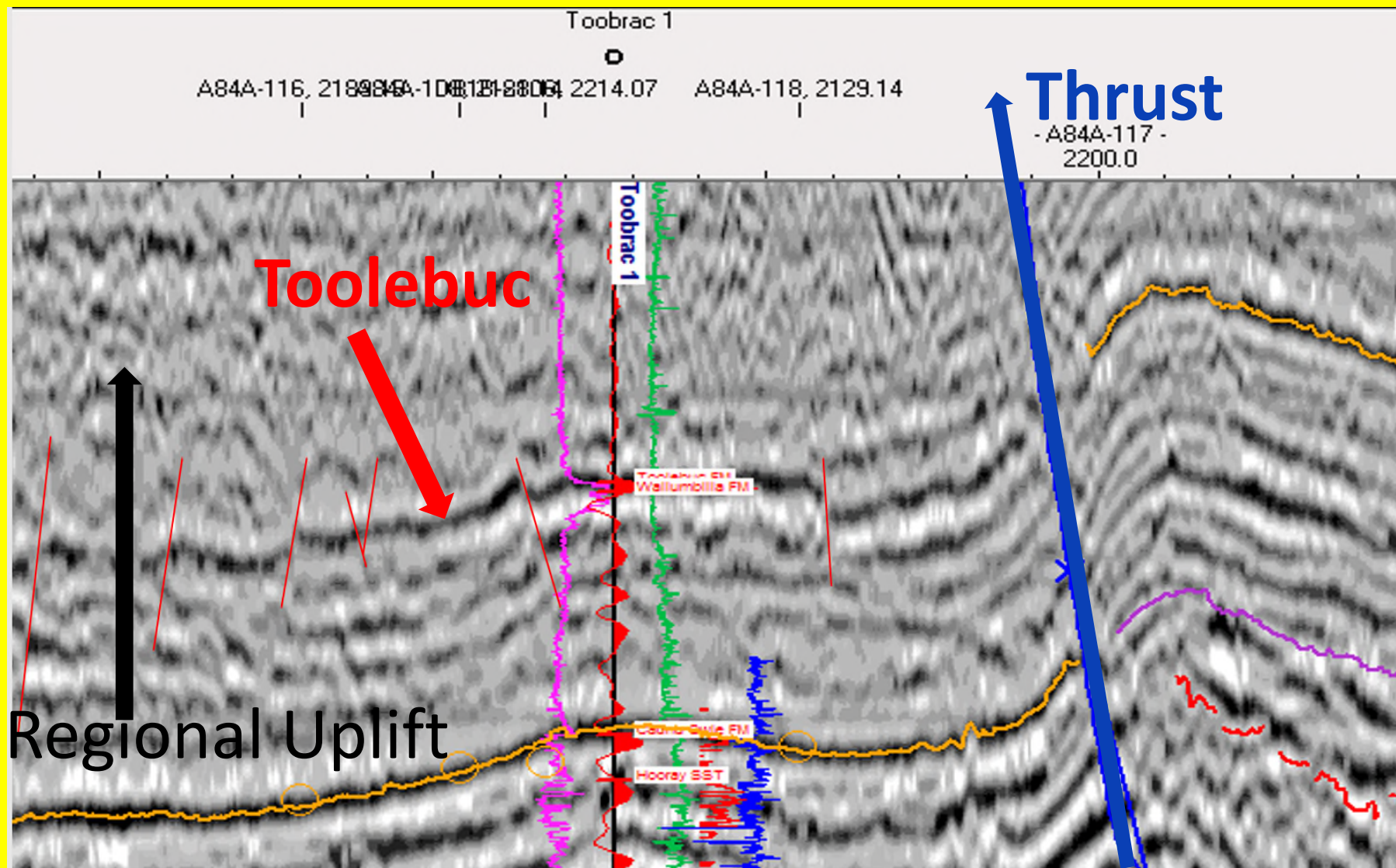


Condamine River Idiocy
Coal Seam Gas/Methane
is thermogenic

The Gas
here is
biogenic

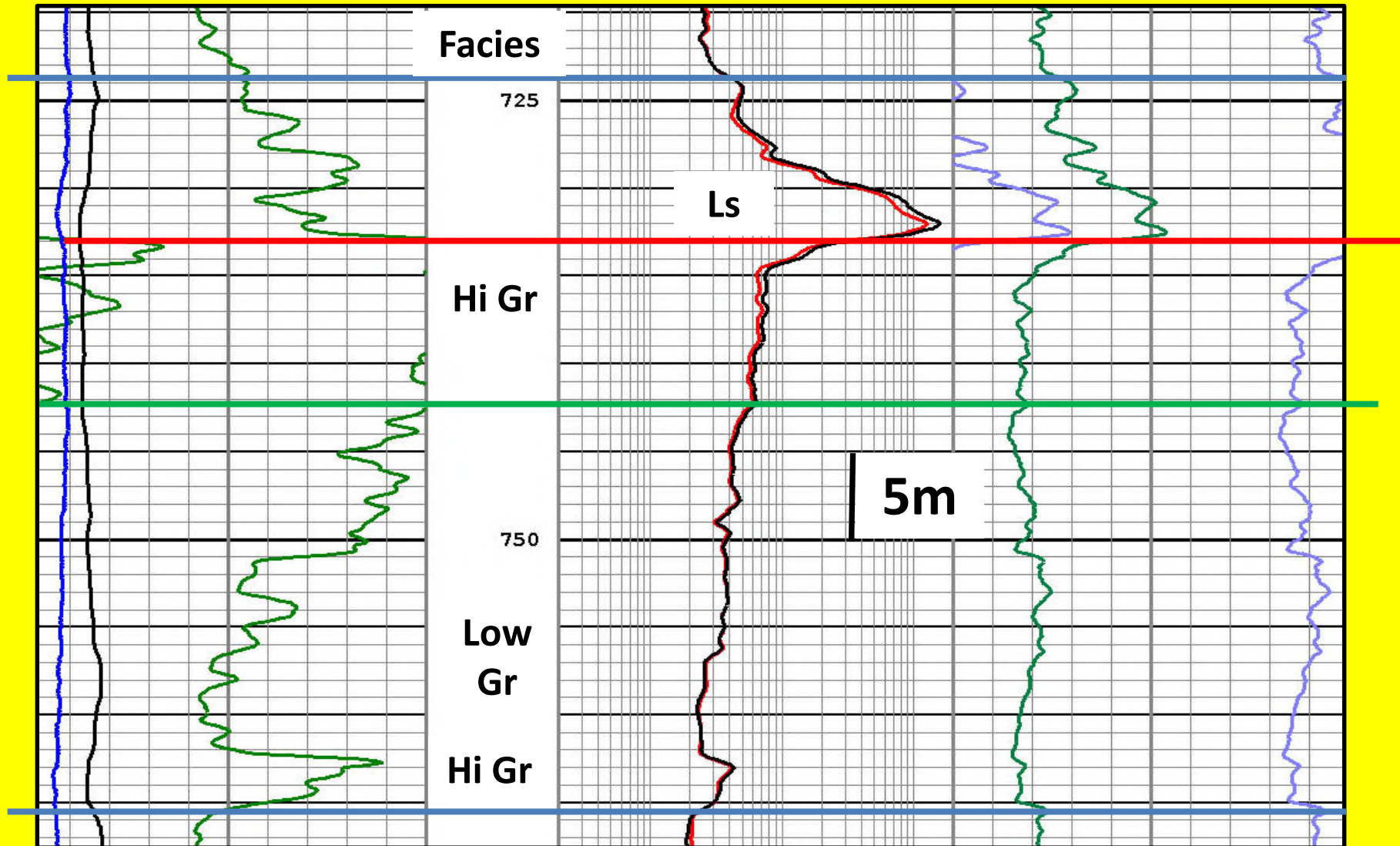
Methane from decomposing vegetable matter after flooding
Has different isotopes – as different as a Rolls and a Mini





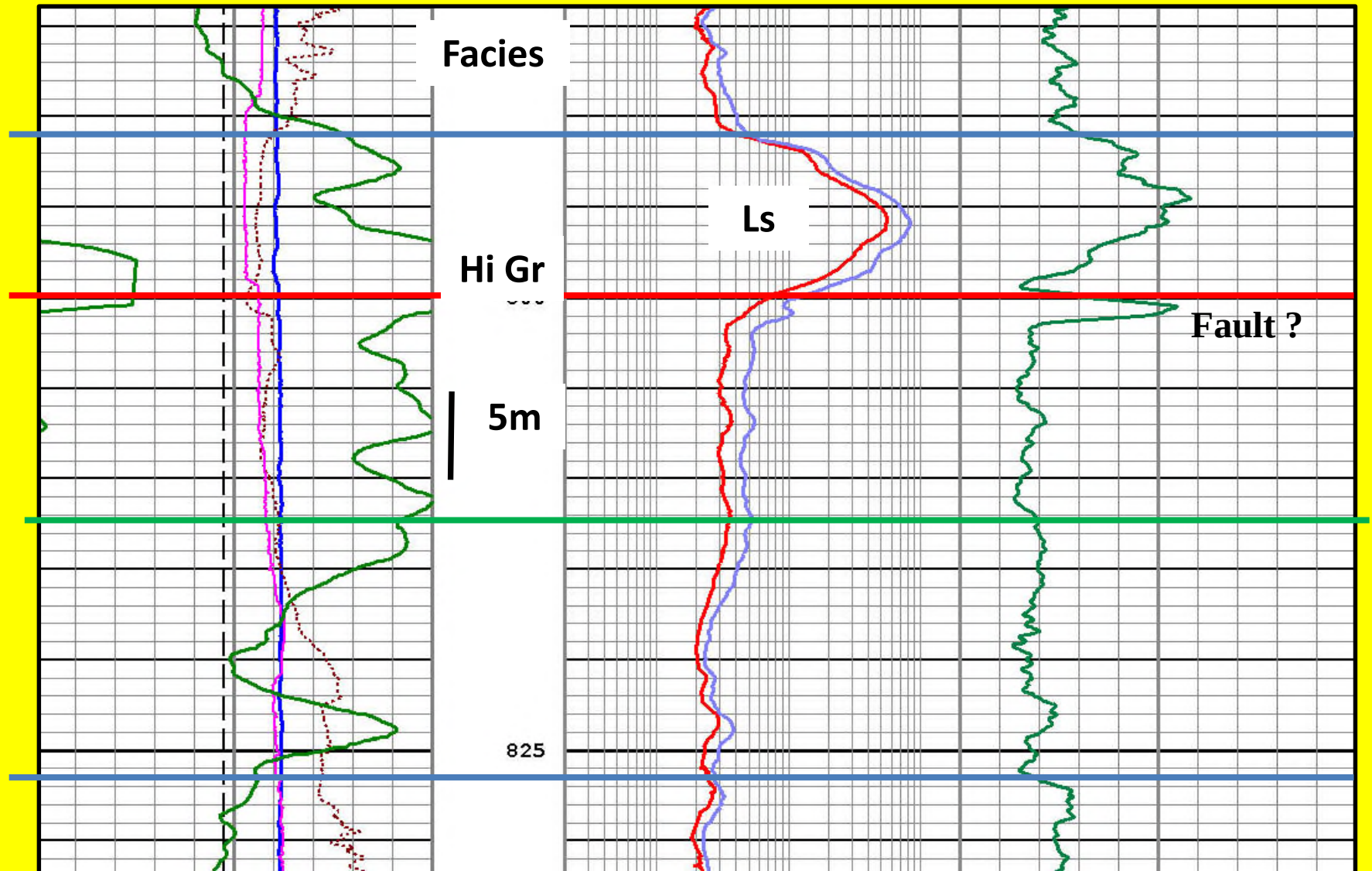
Waterloo 1 Toolebuc

41.5m – 723.5 – 765m?



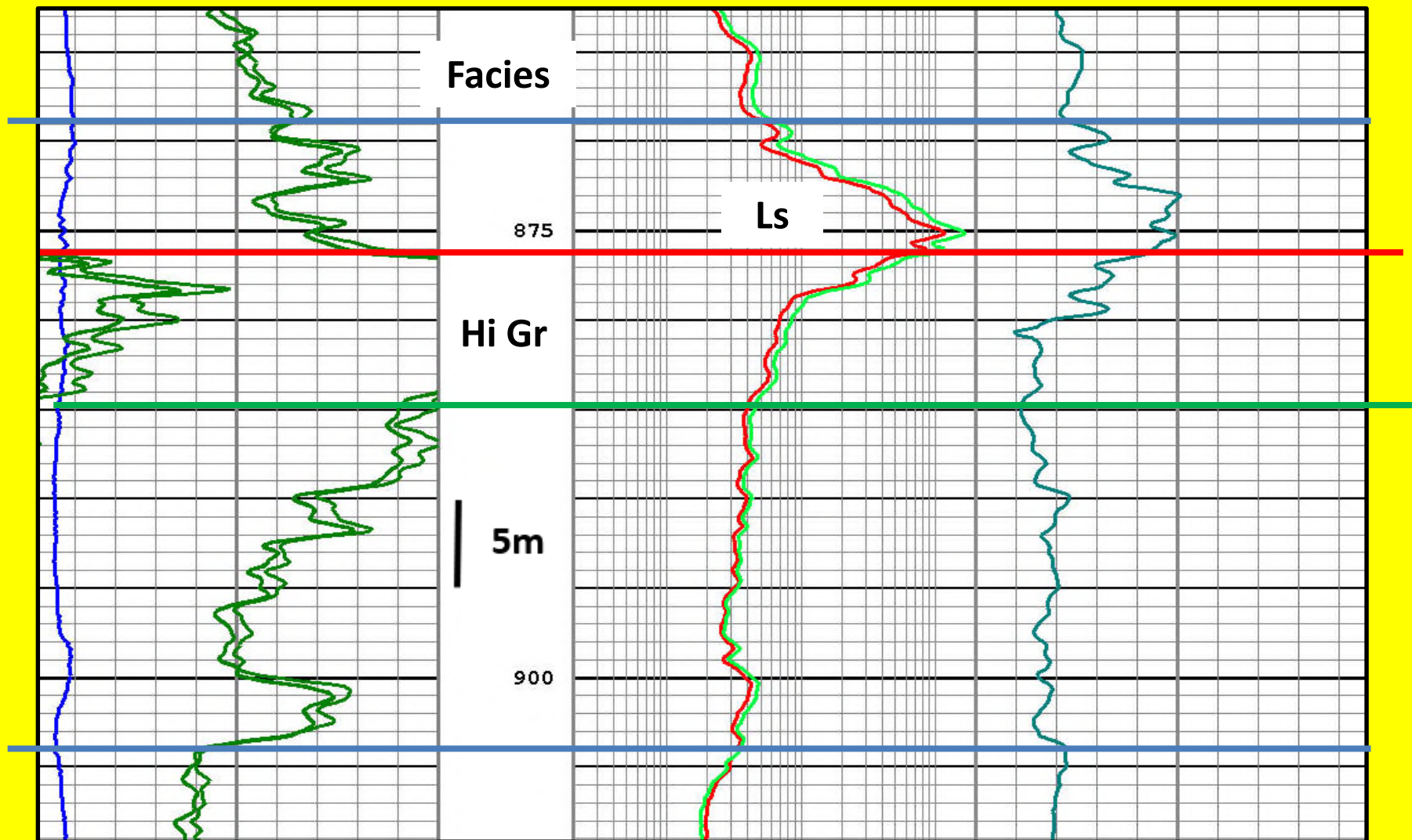
Fermoy 1 Toolebuc

36 m – 791m – 827m?



Pint Pot 1 Toolebuc

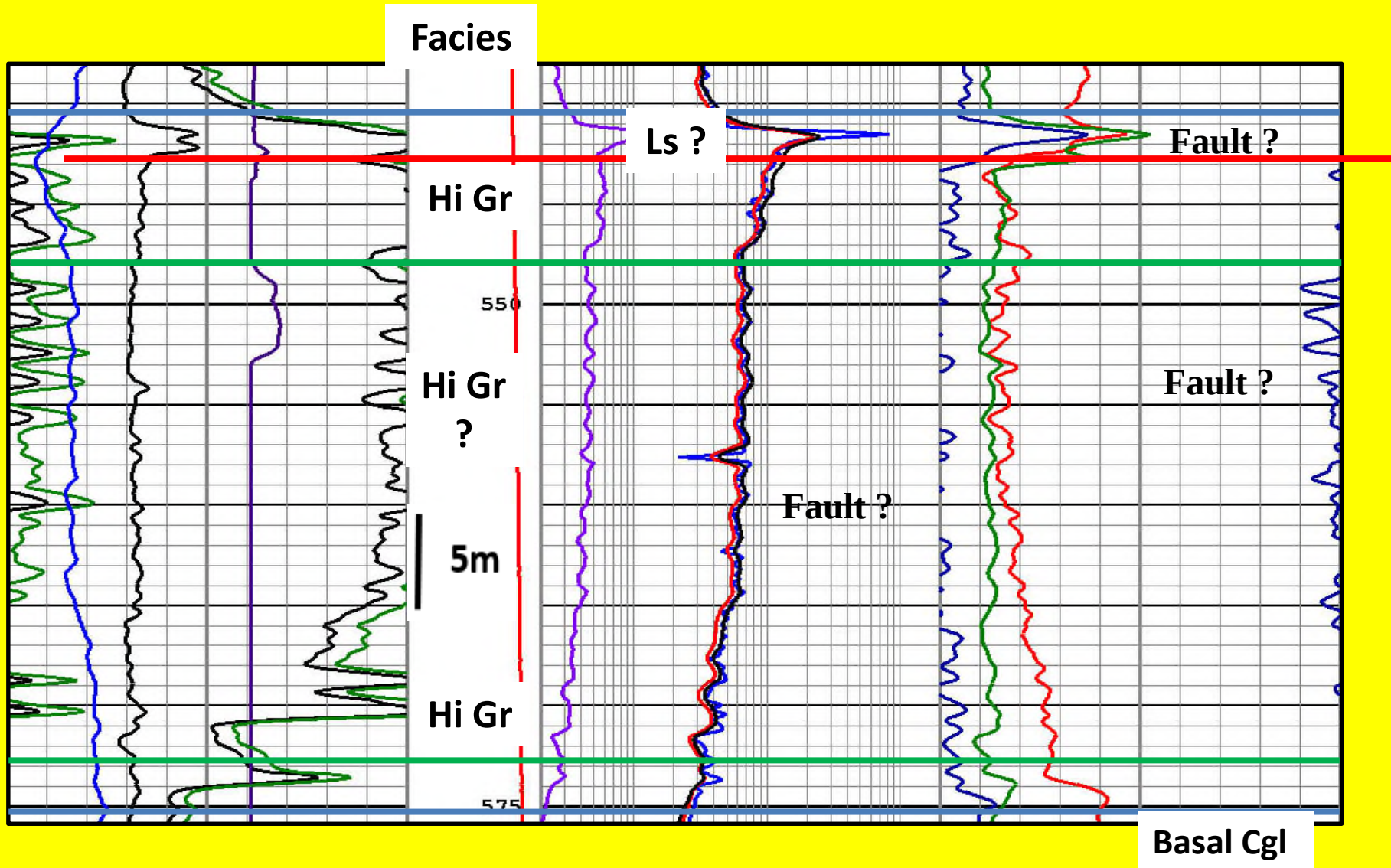
34.5m – 869m – 903.5m?



Euston 1 Toolebuc

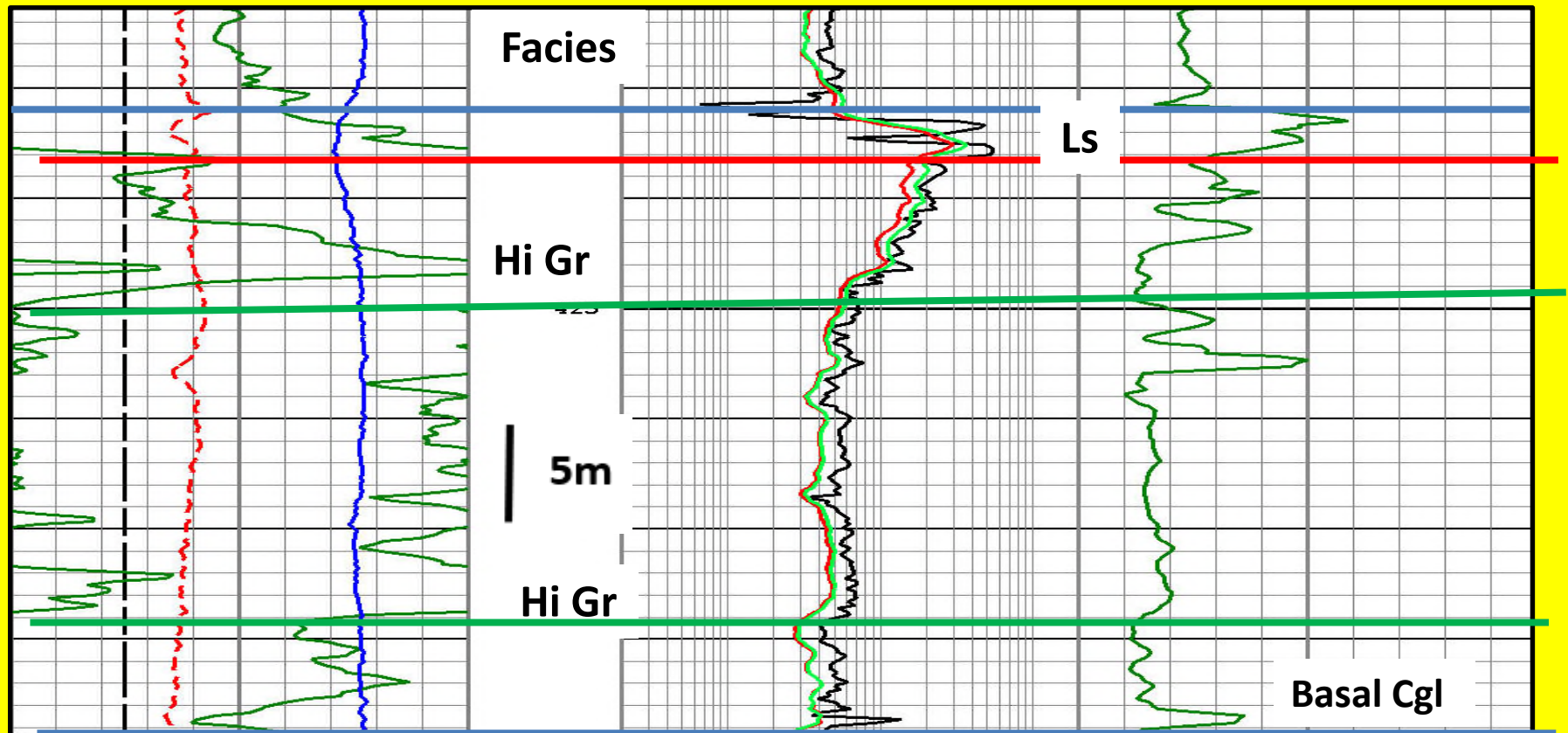
34 m - 540 – 574 m

Limestone Faulted out ?



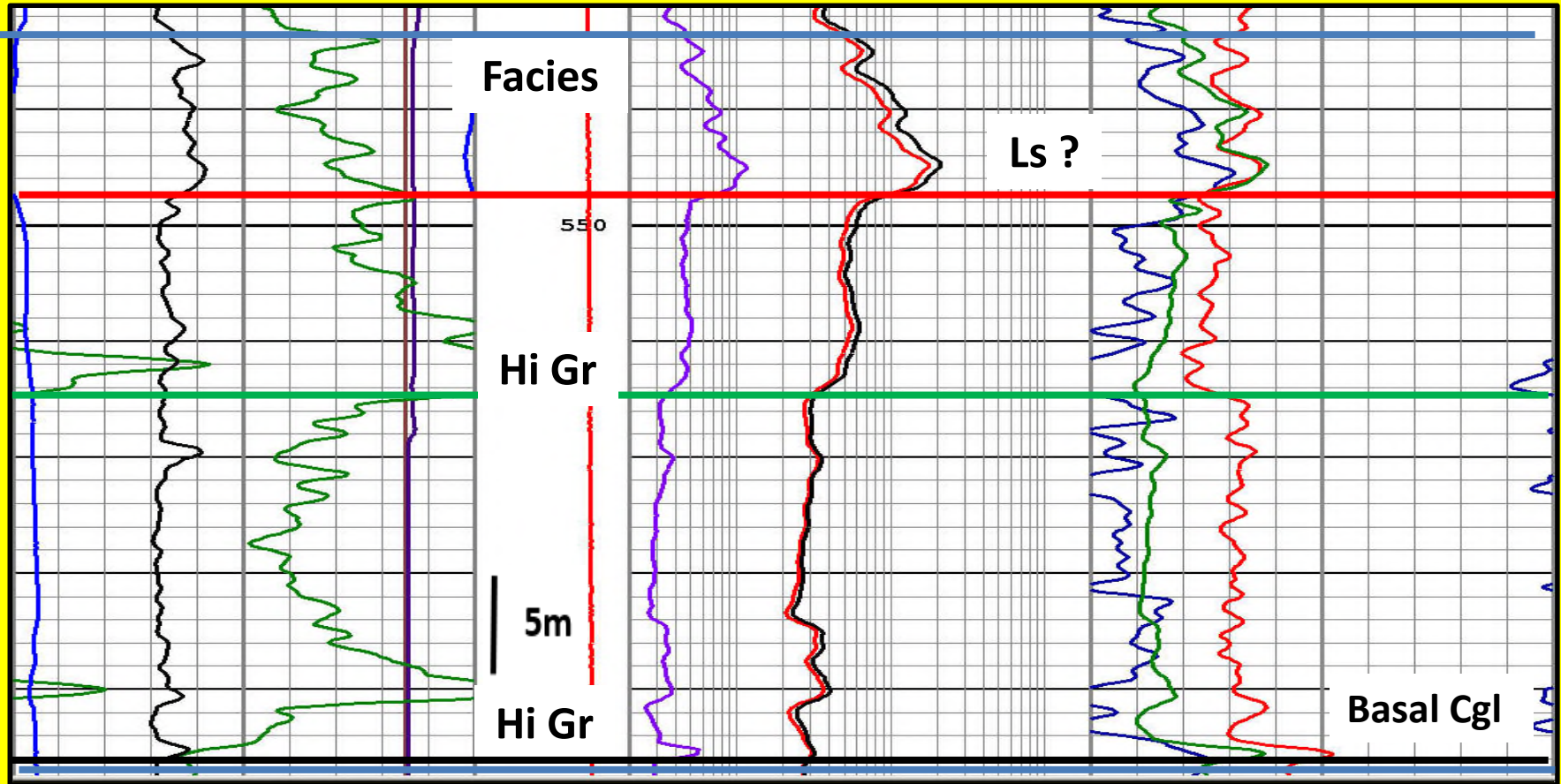
Widnerpool 1 Toolebuc

29m - 414 – 443m



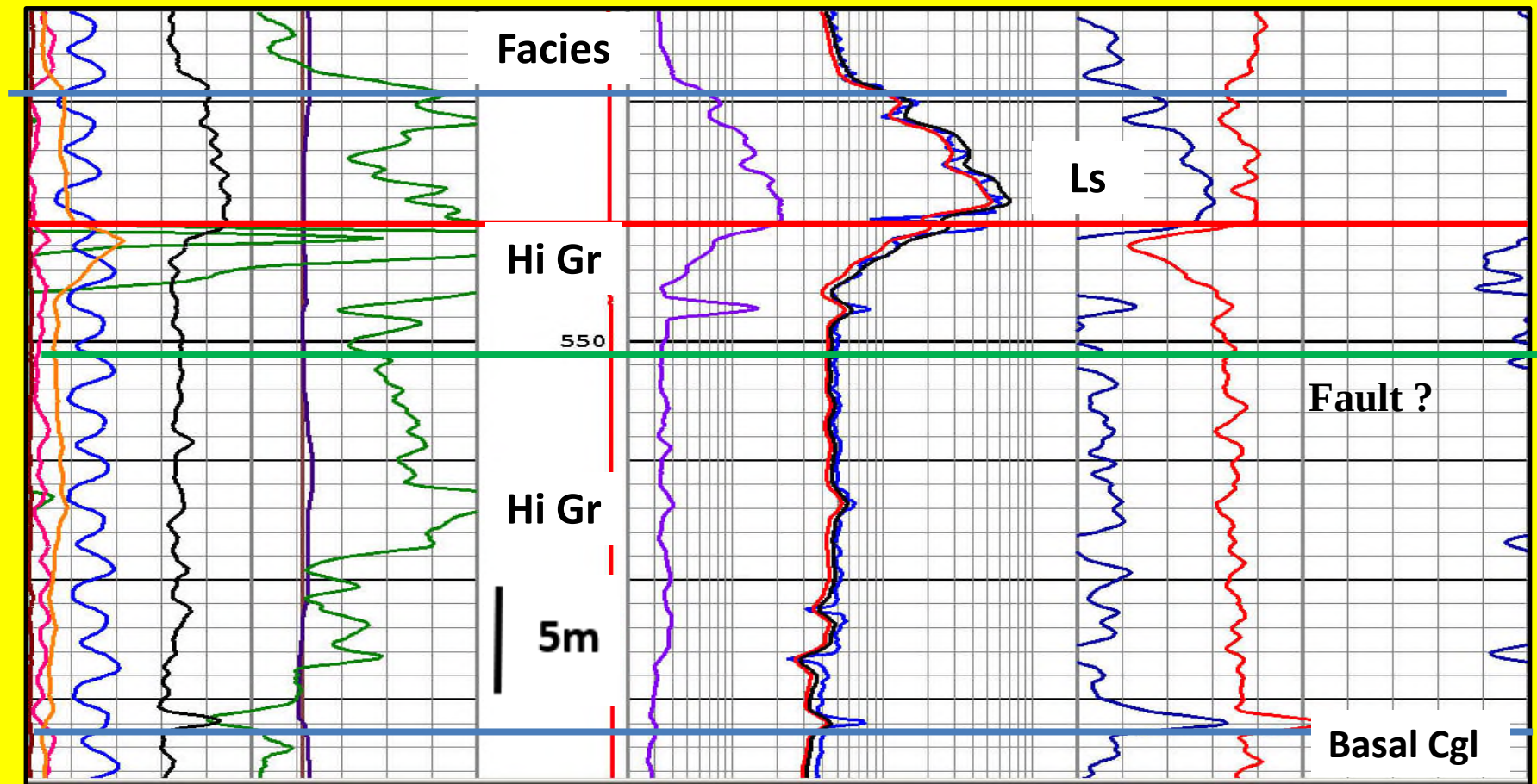
Darr 1 Toolebuc

28 m – 541.5 – 572.5m Limestone Not Present ?



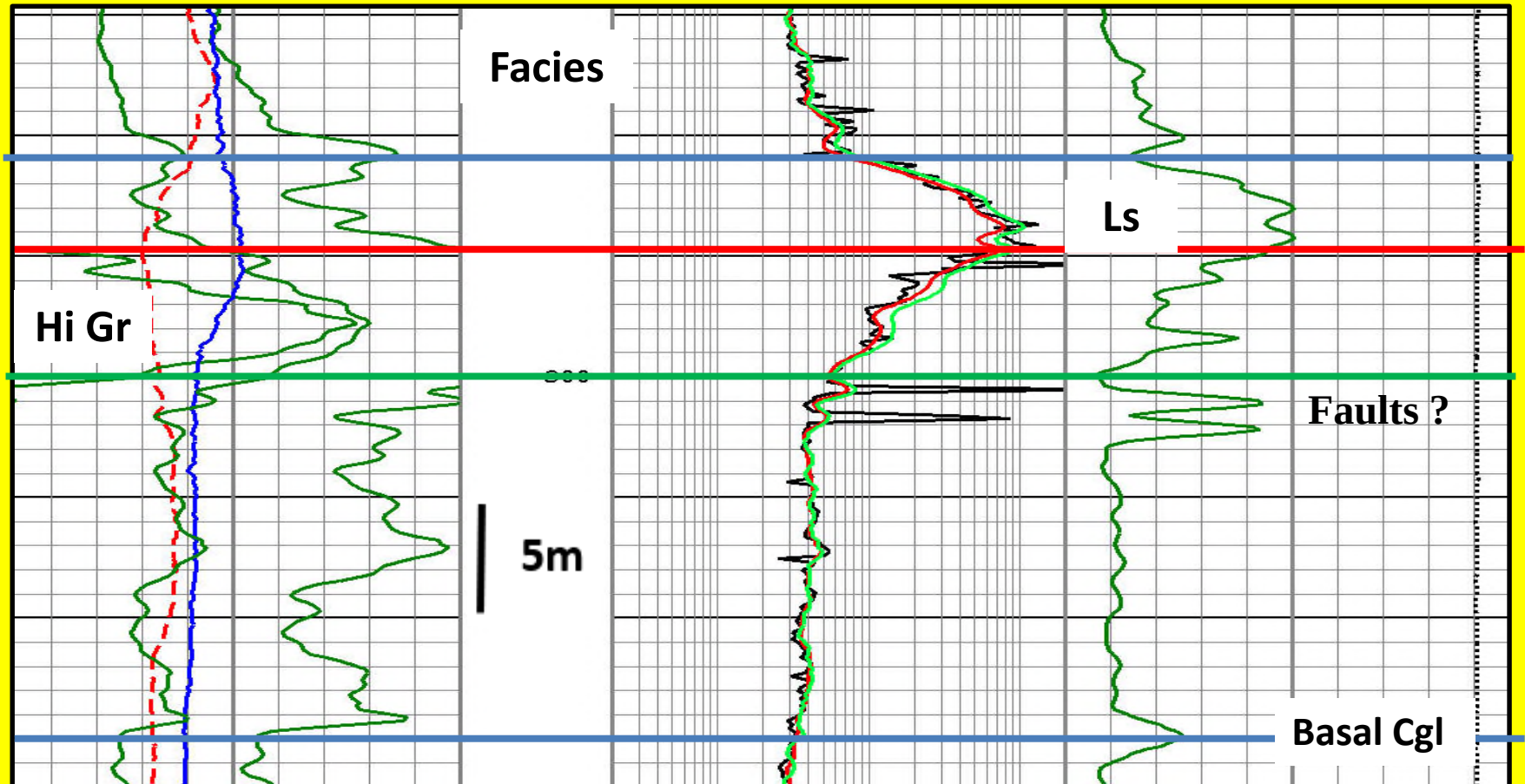
Katherine 1 Toolebuc

27 m - 539 – 566m



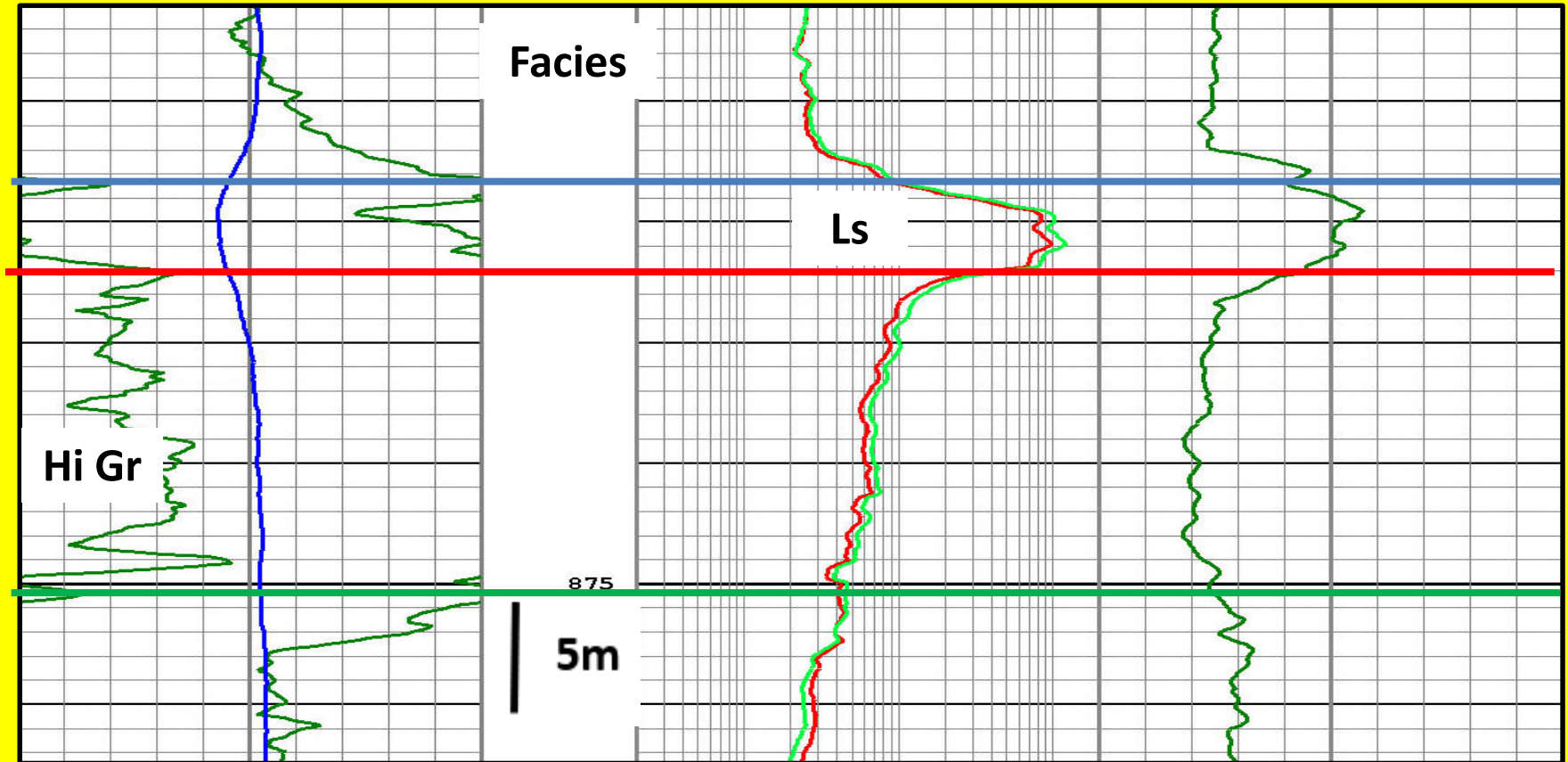
Upshot 1 Toolebuc

24.5m – 290m – 314.5m



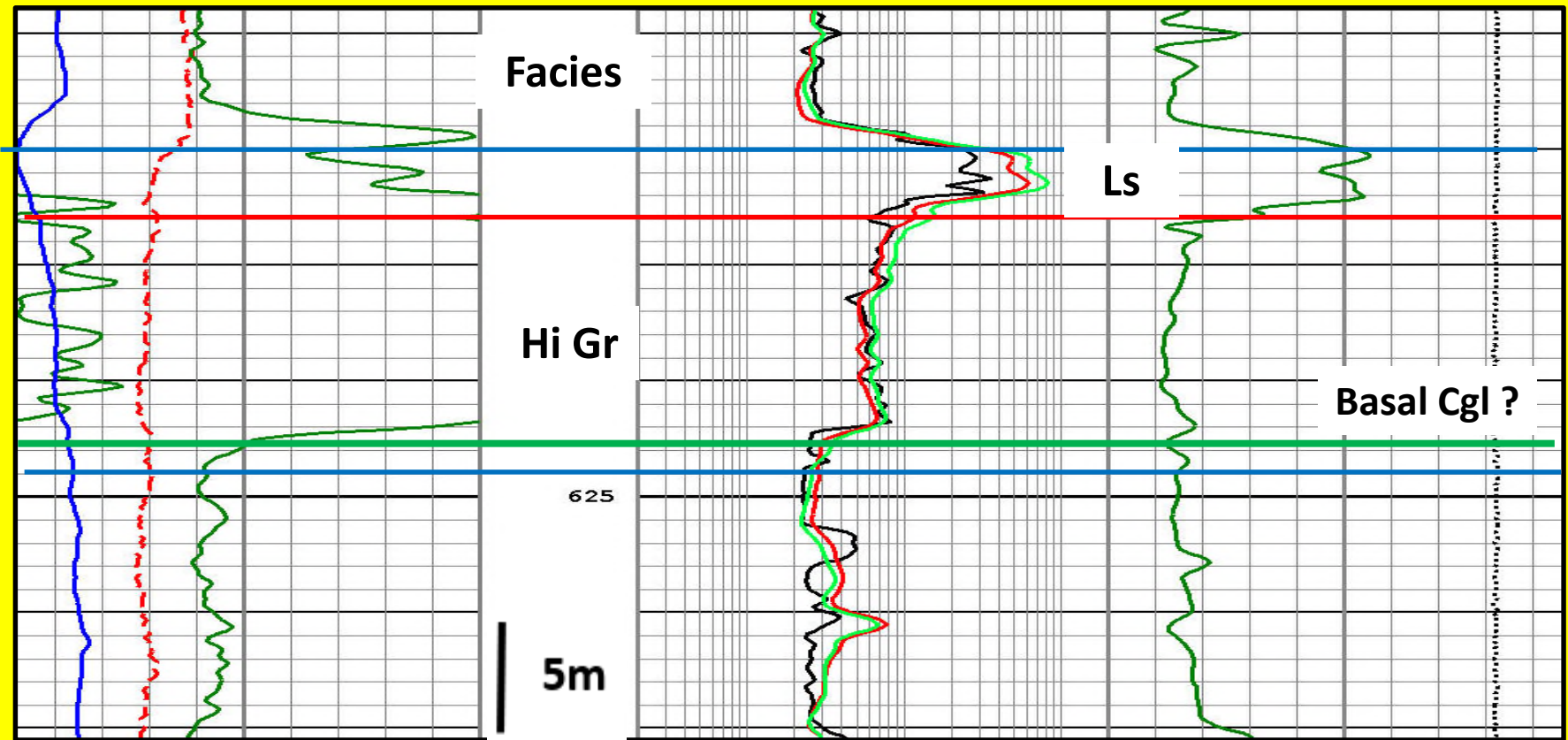
Silsoe 1 Toolebuc

21m - 857 – 878m



Alfred Downs 1 Toolebuc

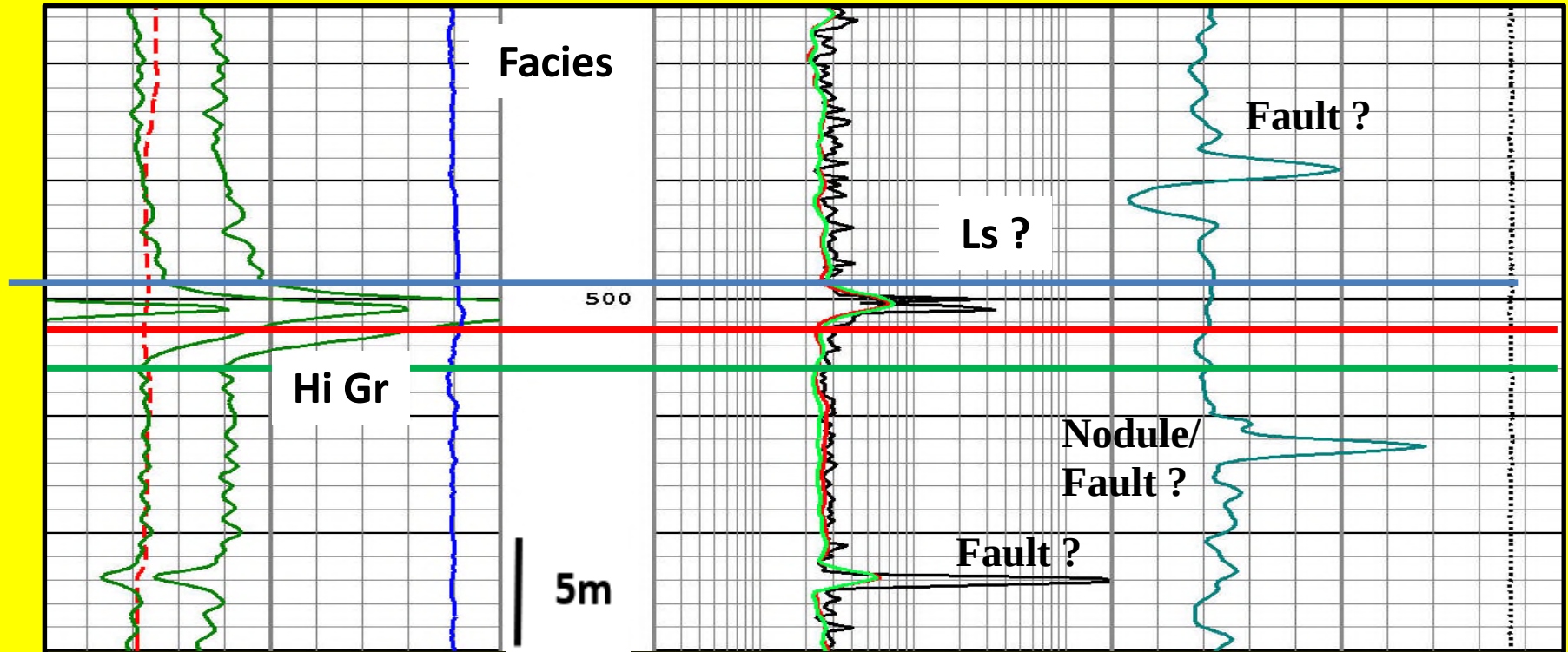
13m - 609 – 622m



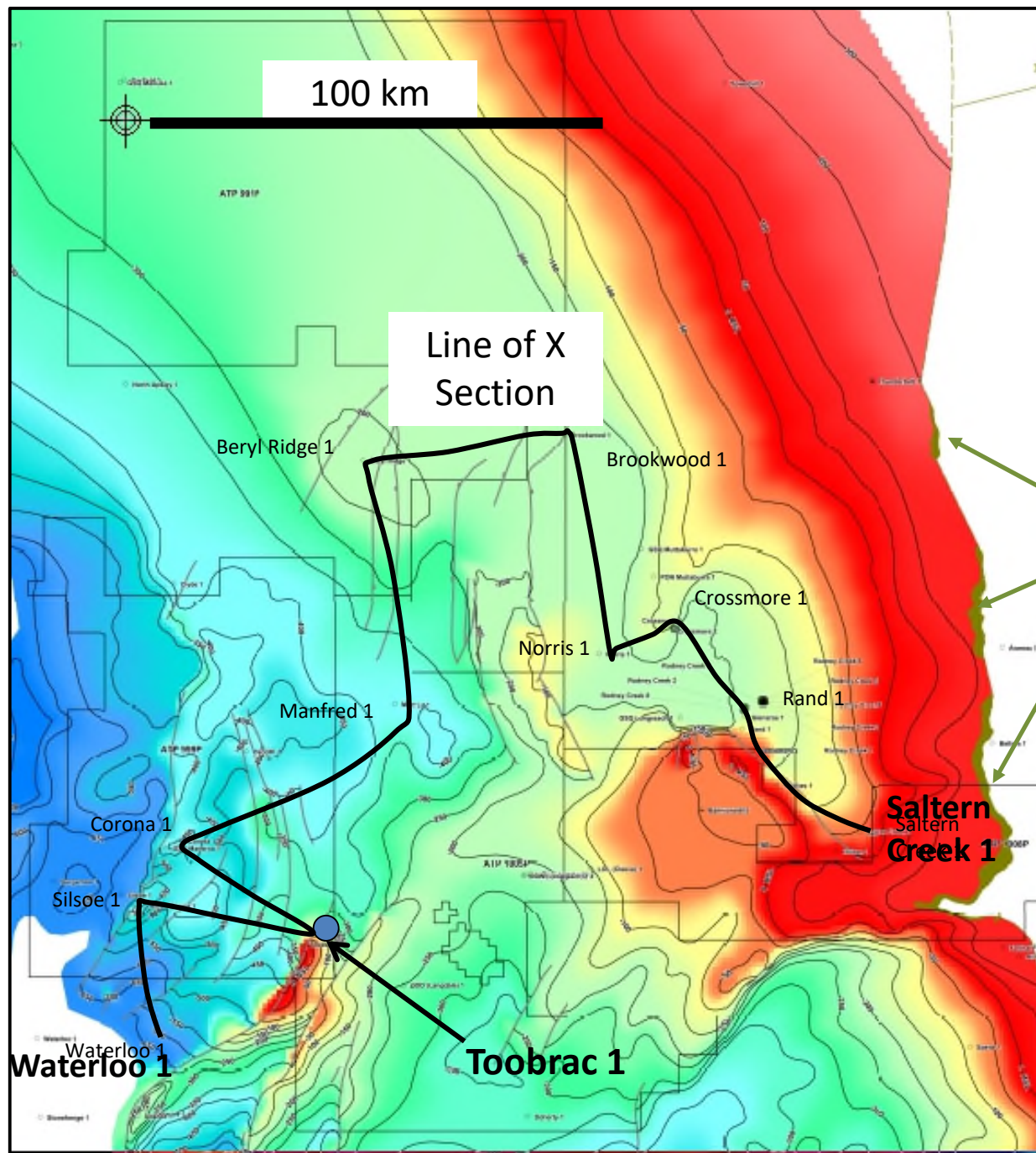
Stratavon 1 Toolebuc

3m – 499m – 502m

ALL FAULTED OUT ?



Fault ?



	< 50 m ss
	-50 - 150 m ss
	-150 – 350 m ss
	350 - 500 m ss
	>500 m ss

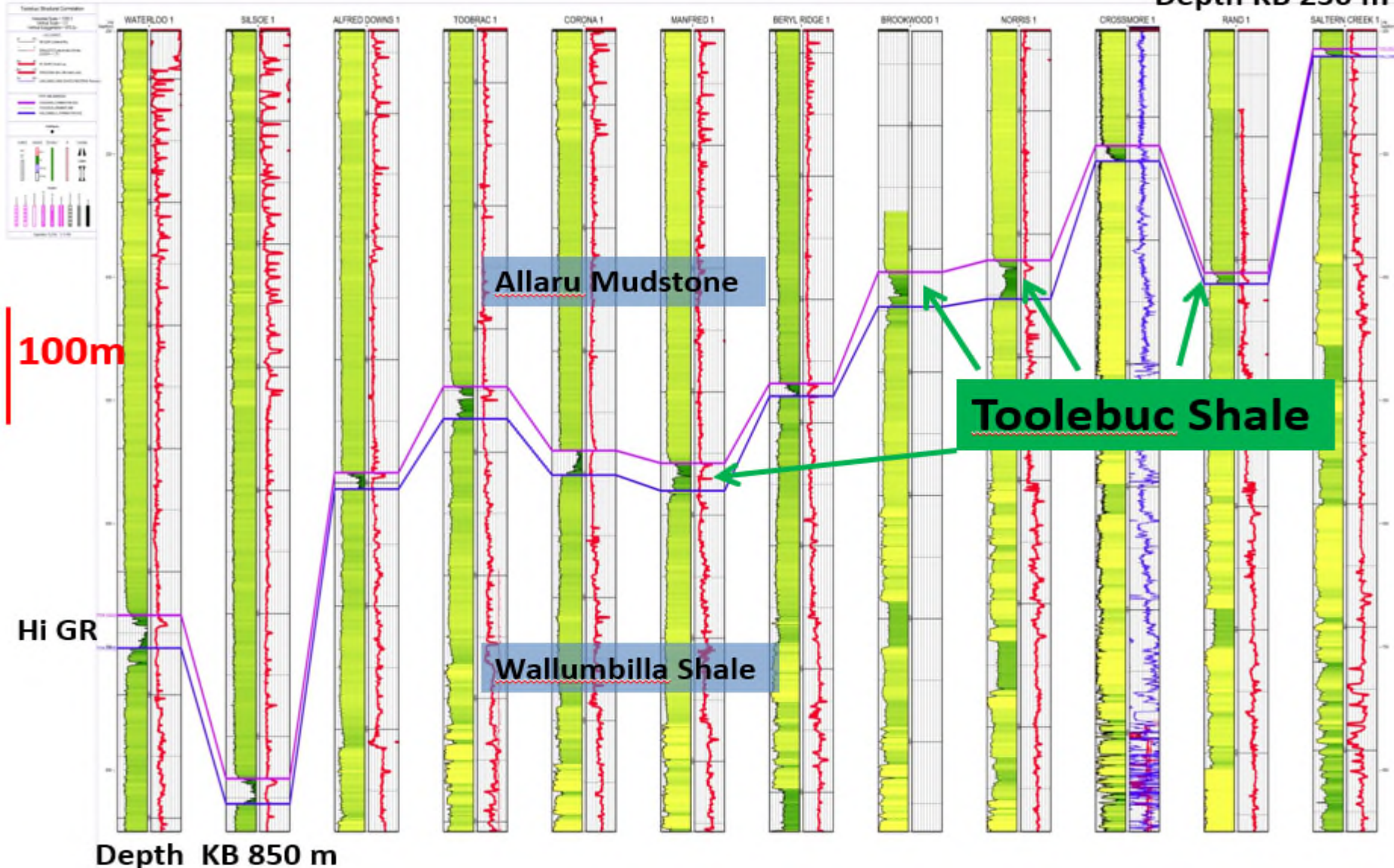
Toolebuc Shale Sub Sea Depth Map & Cross Section

Toolebuc S-N Structural Cross Section Longreach Area

Saltern
Creek 1

Waterloo 1

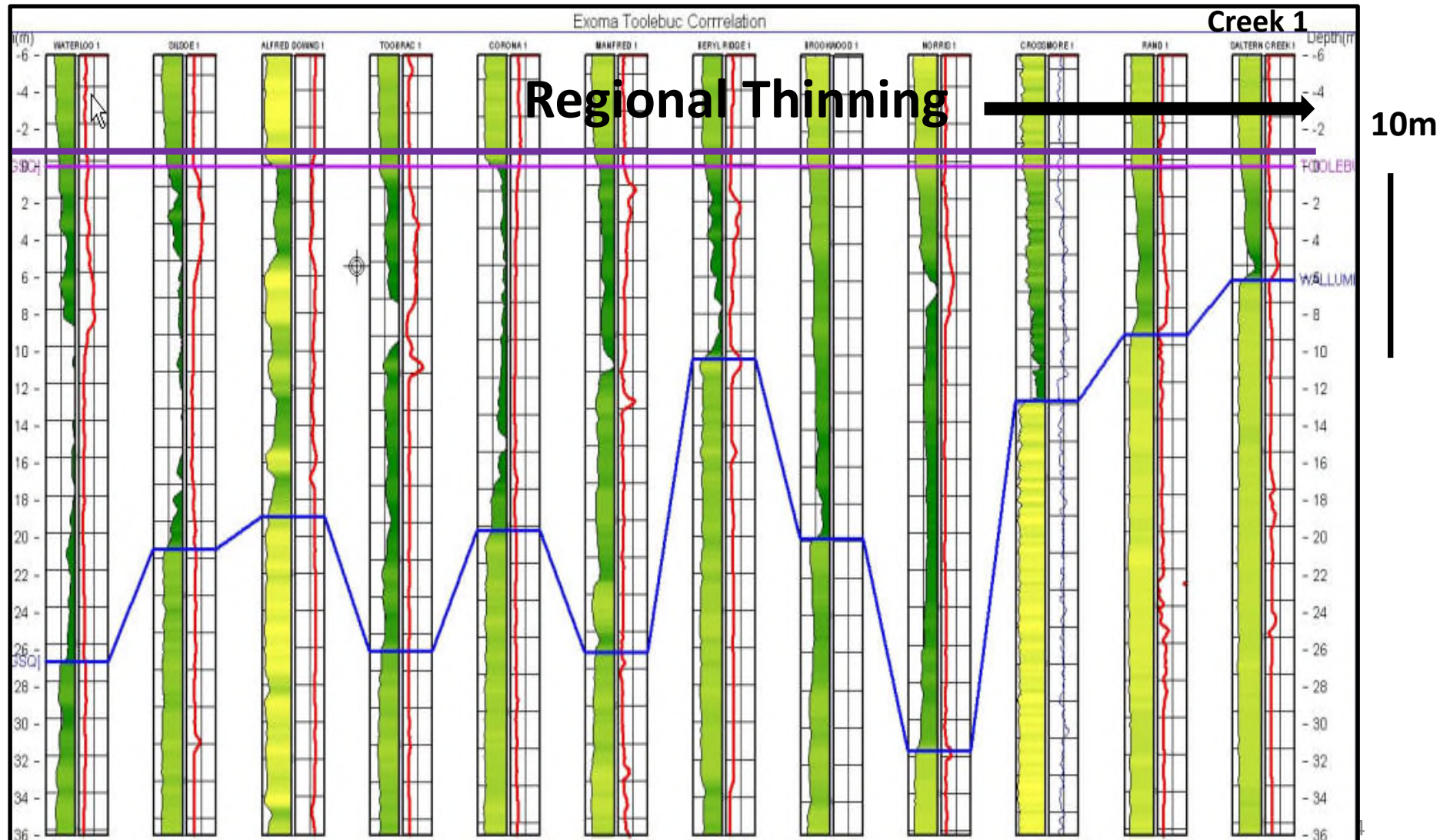
Depth KB 250 m

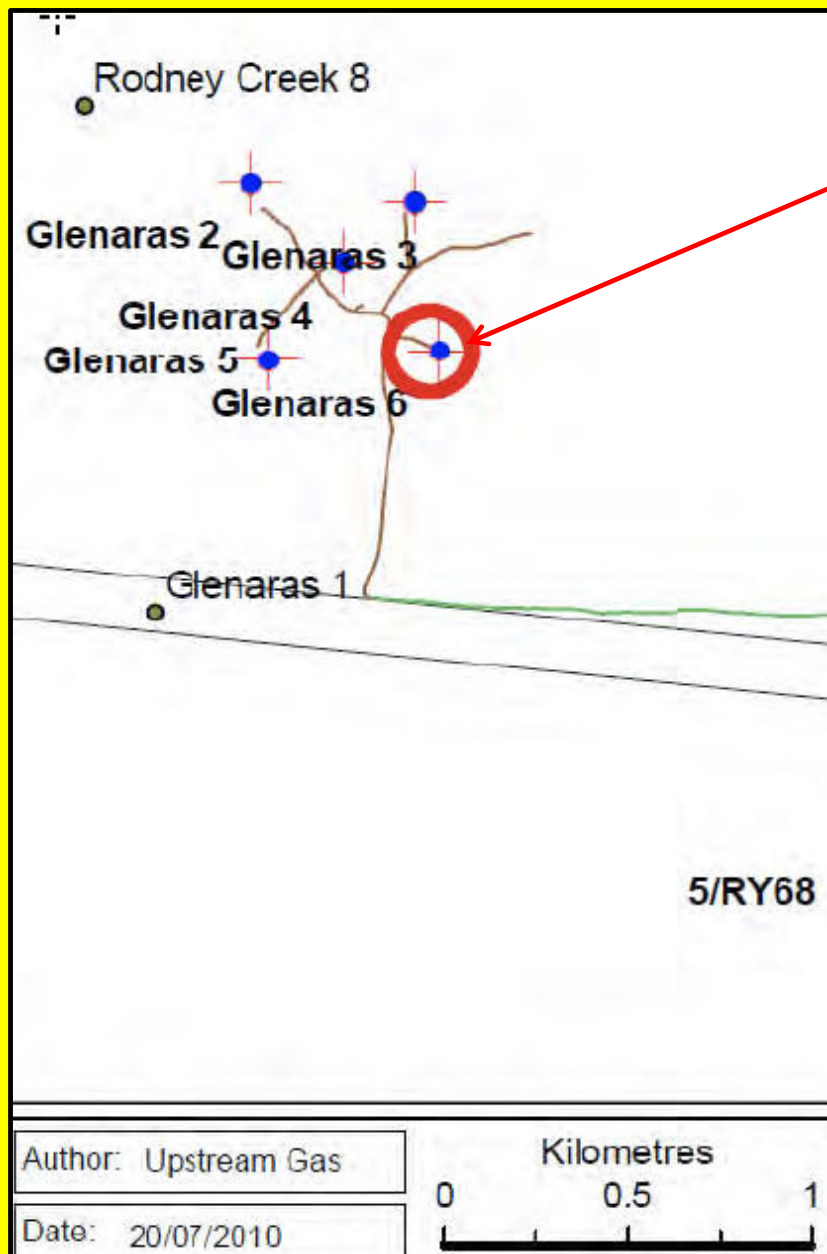


Toolebuc Stratigraphic Cross – Section Differences in thickness due to faulting, NOT just depositional thinning

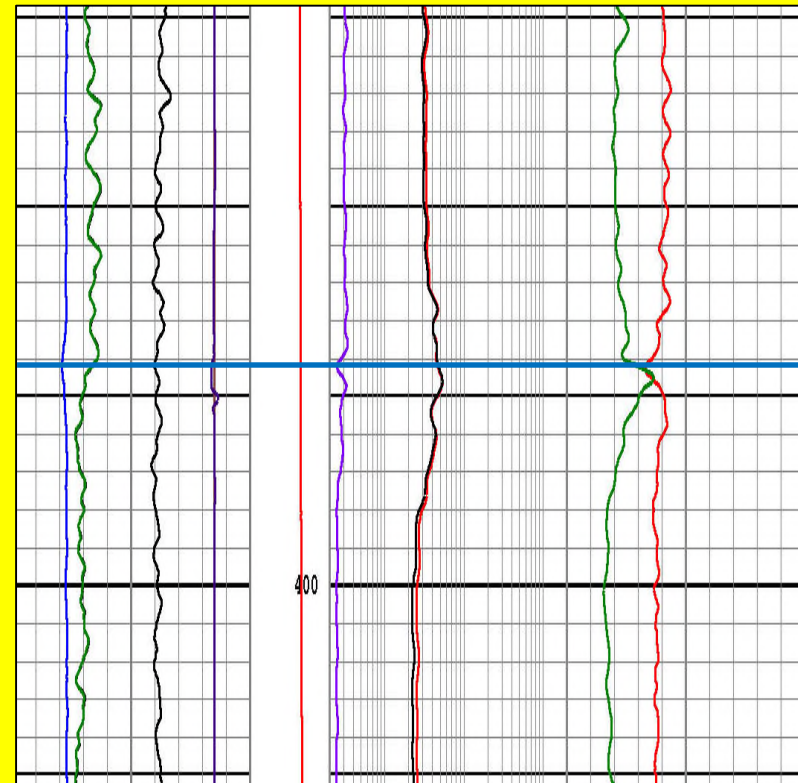
Waterloo 1

Saltern Creek 1

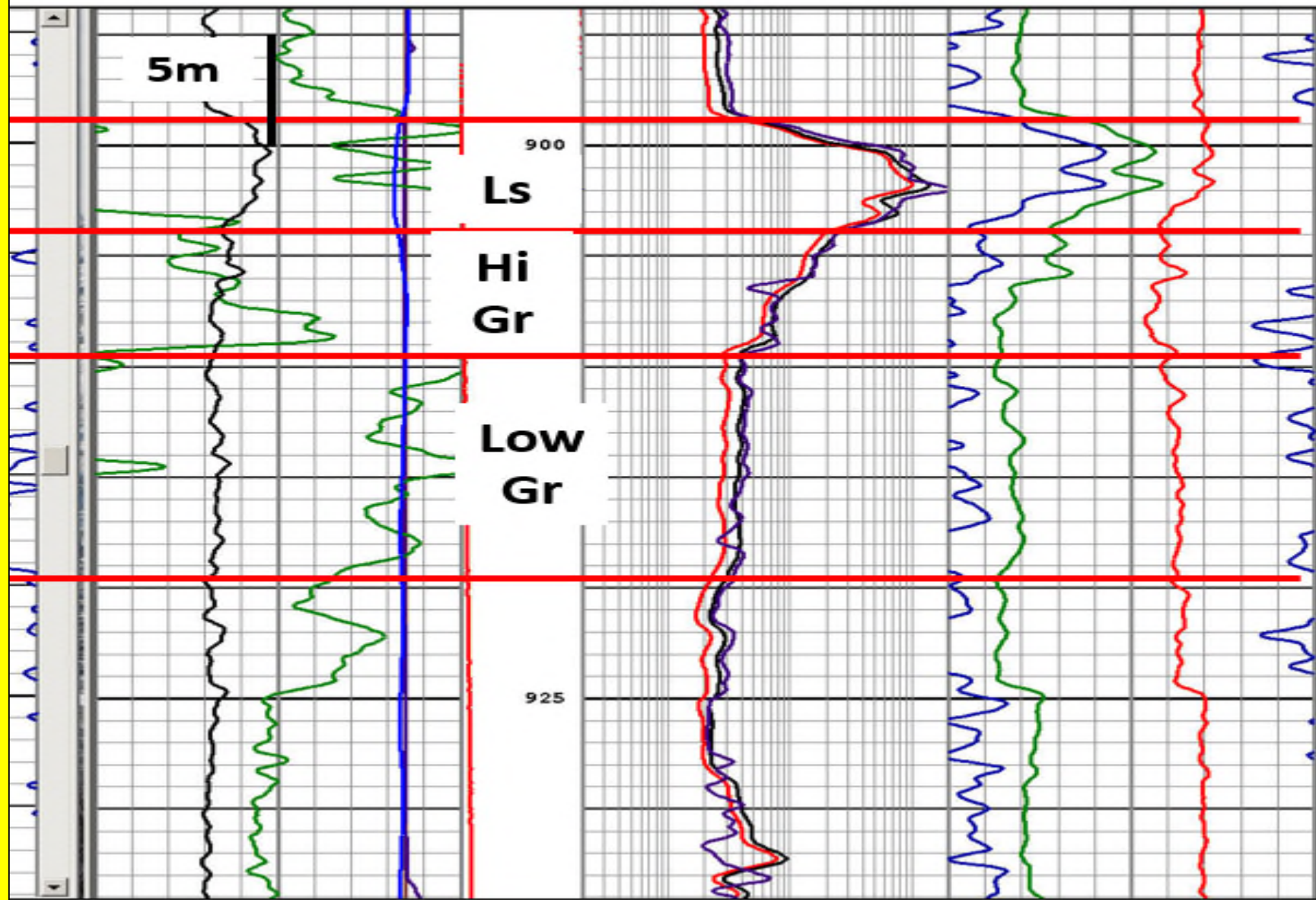




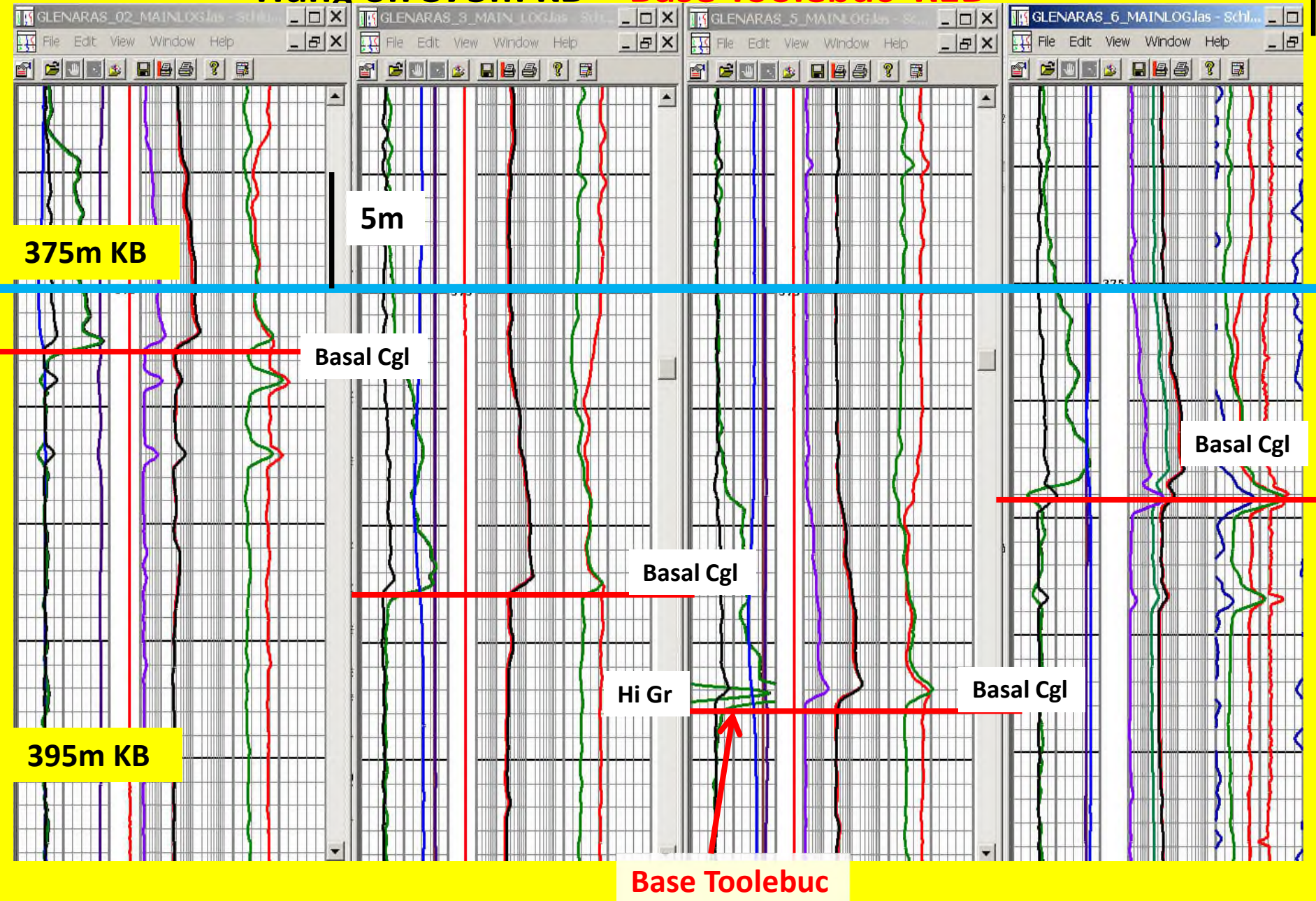
Glenaras 4
NO Toolebuc



Glenaras Area 1 Toolebuc



Structural Cross Section, Glenaras 6 - 2 – 3 – 5 - Approx 500m apart^{5m}
Hung on 375m KB - Base Toolebuc RED



Sardine 09 – Line 7 and Glenaras 4

Toolebuc

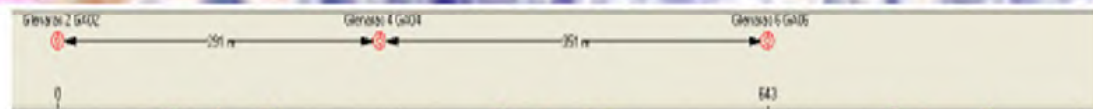
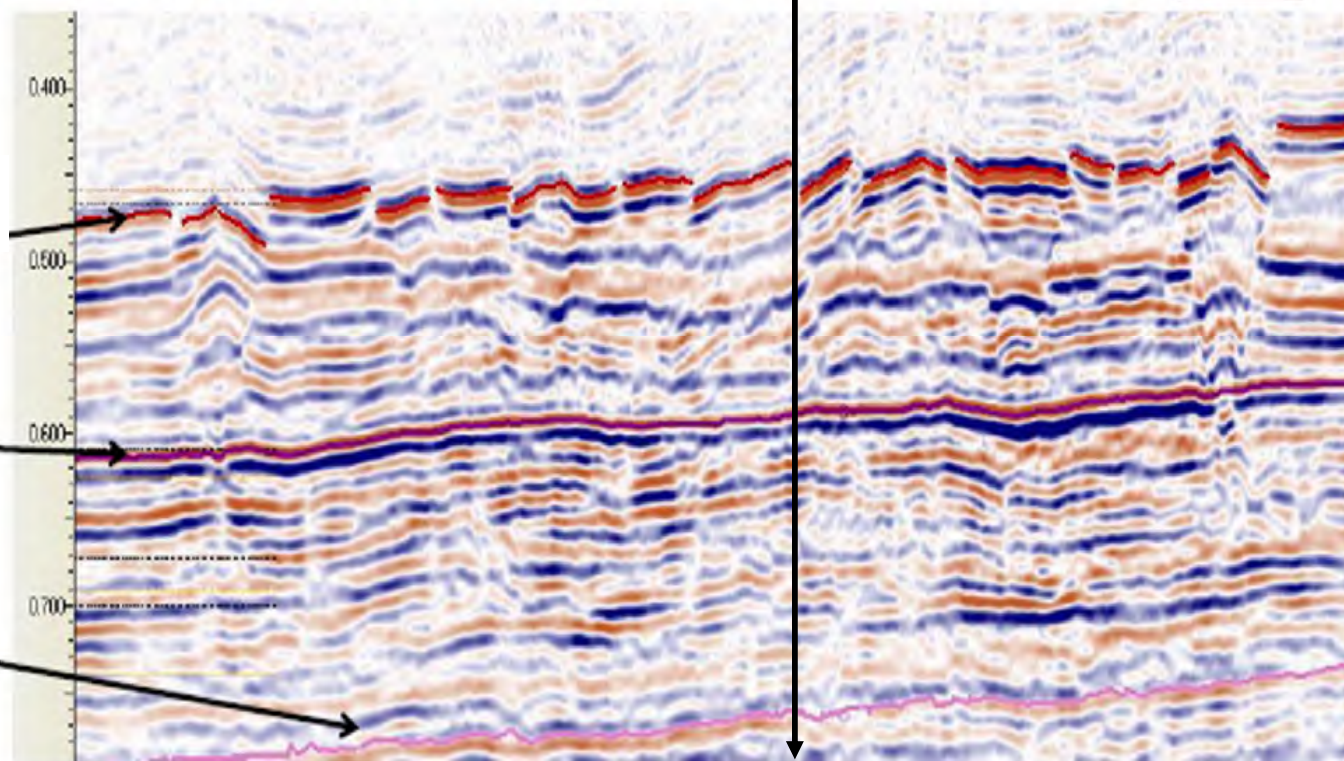
(Red)

Cadna-Owie Top

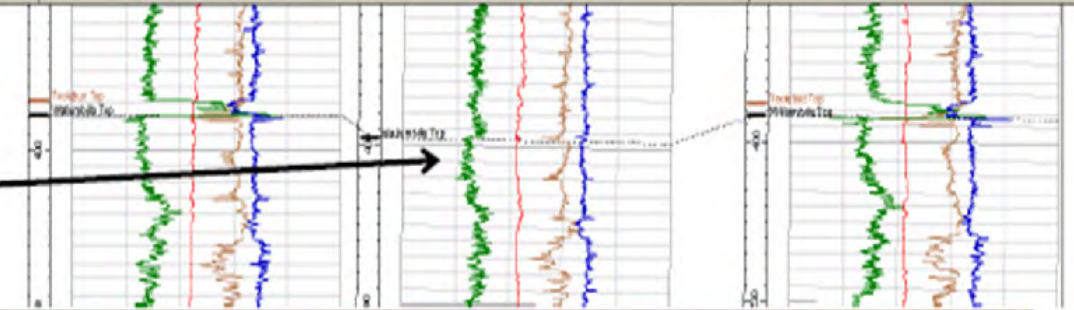
(Purple)

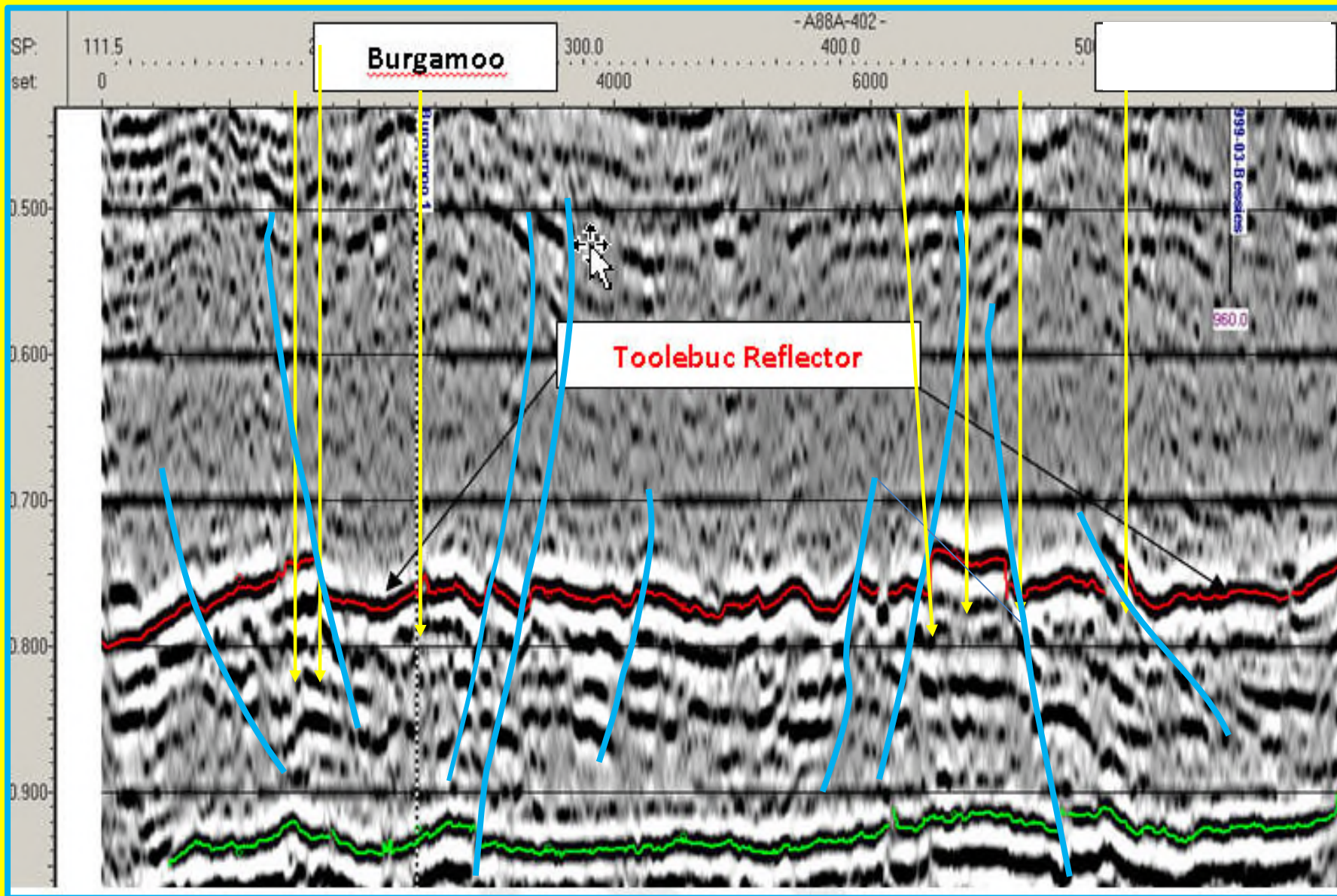
Hutton Sandstone
Base

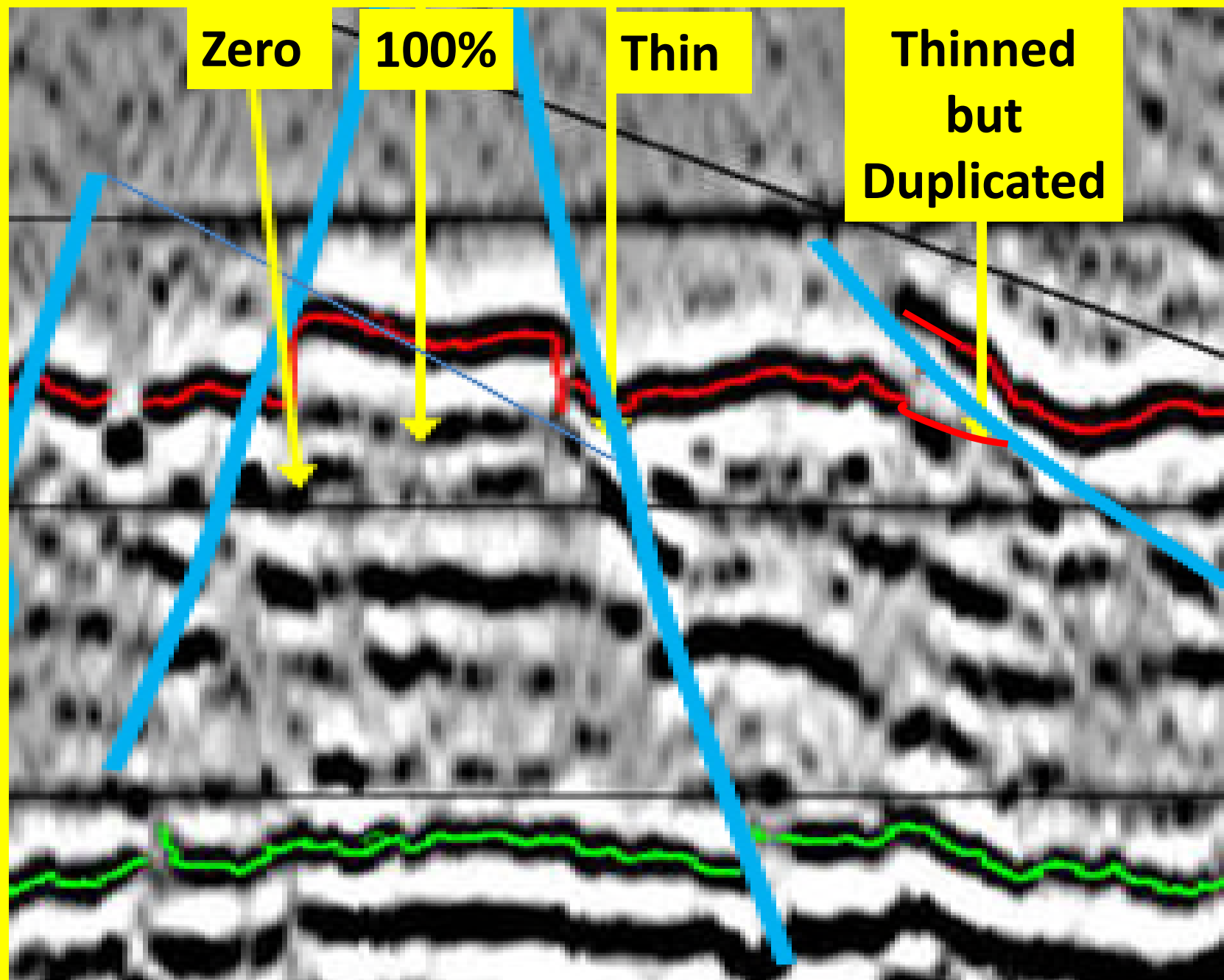
(Pink)



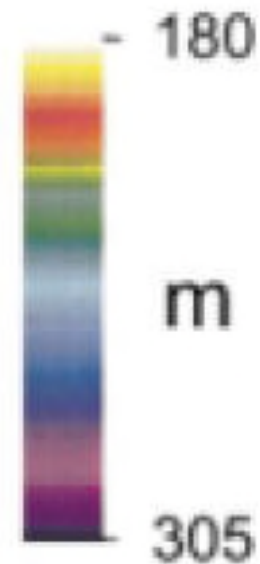
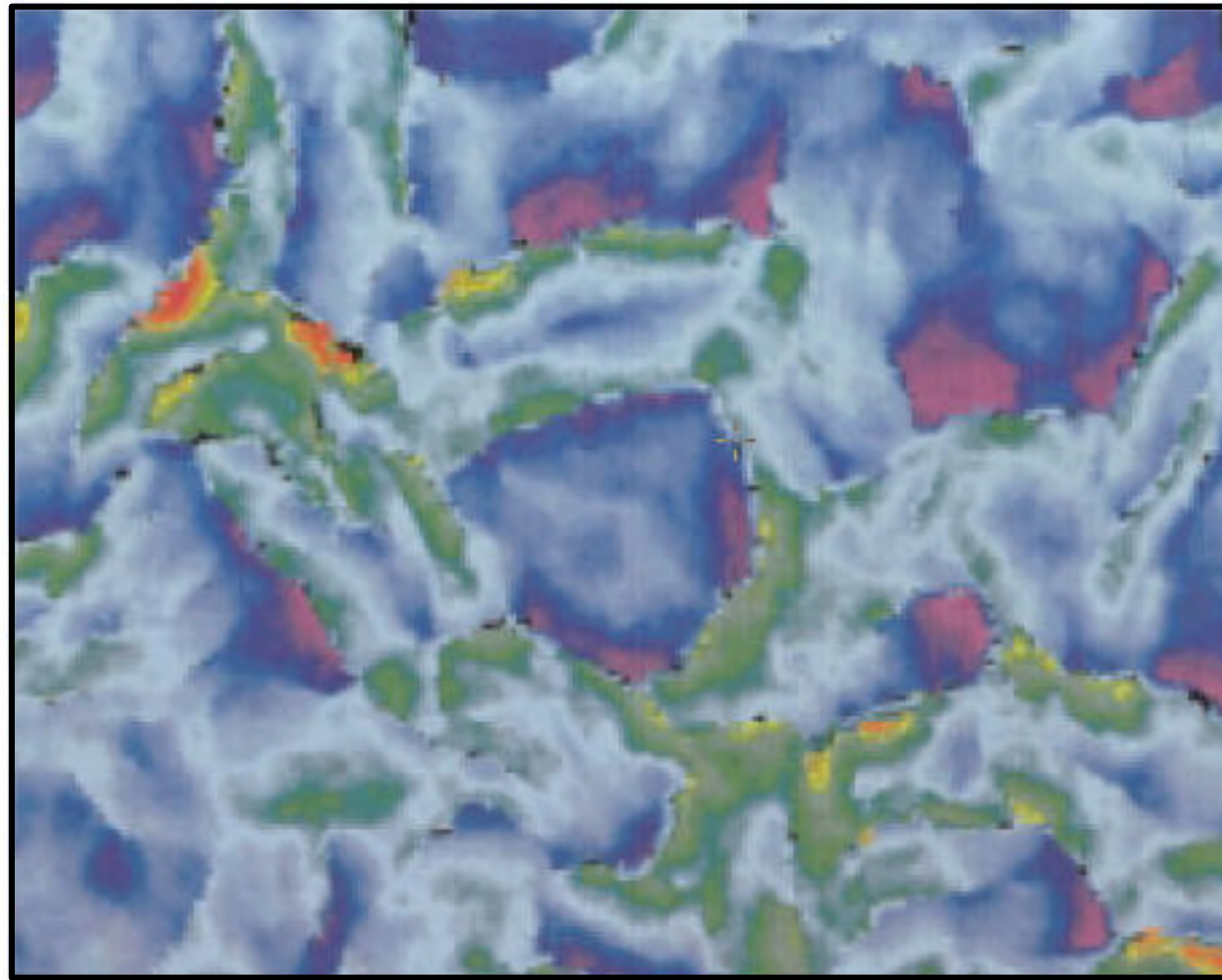
Toolebuc not encountered



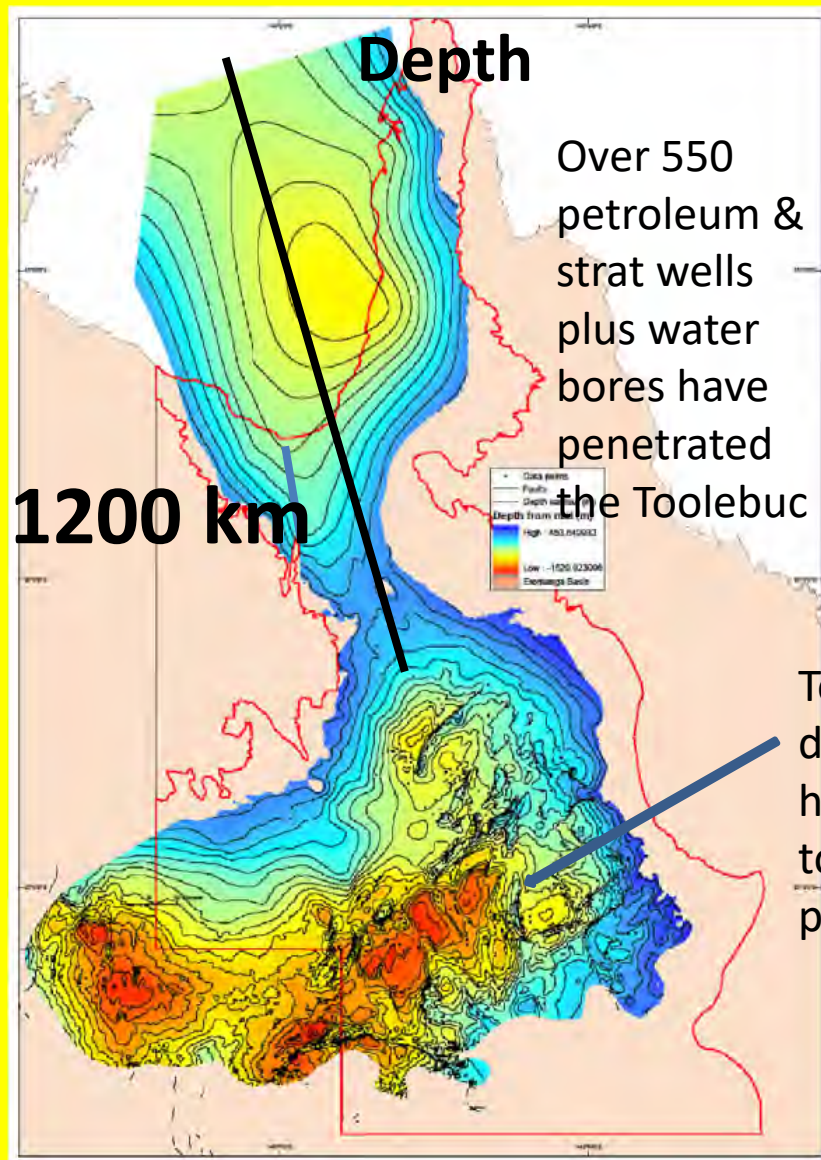




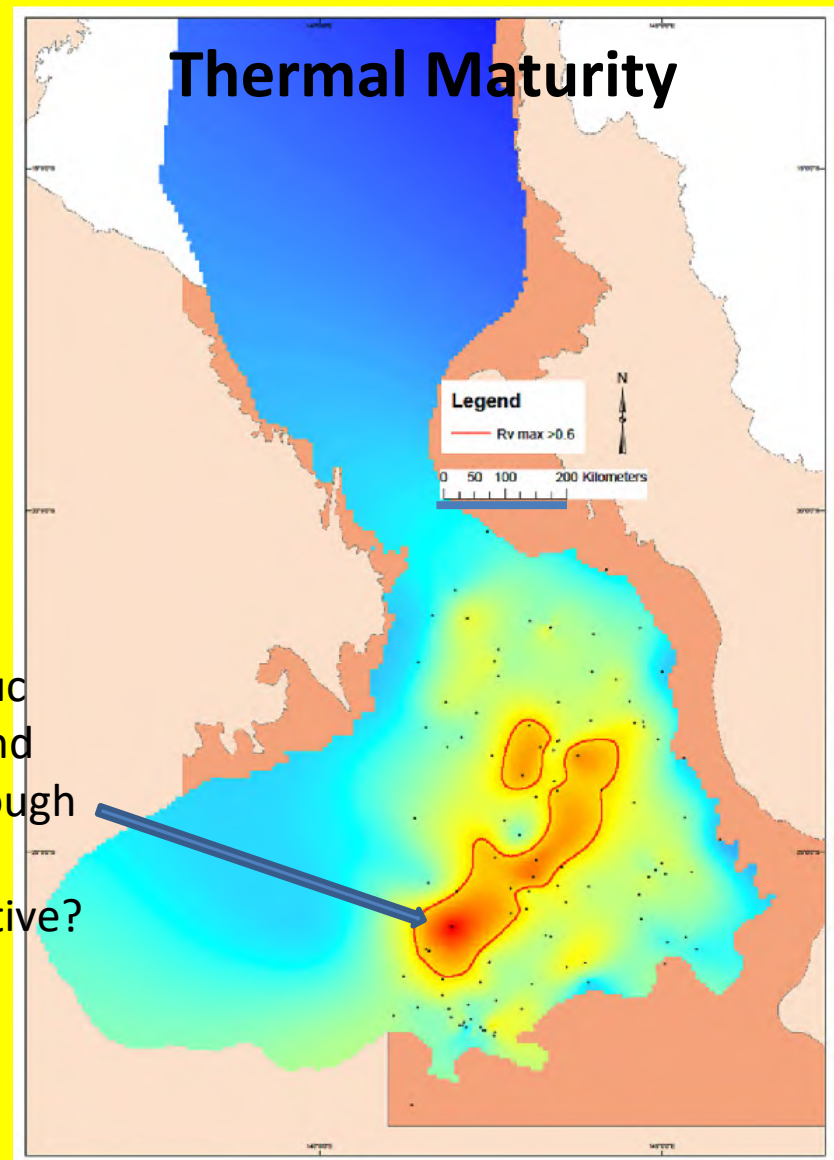
Toolebuc Shale type polygonal tessellated surface from 3D seismic



2 km



Toolebuc deep and hot enough to be productive?



Toolebuc Formation - unconventional hydrocarbon potential

Alison Troup, Melanie Fitzell and Sally Edwards
Geological Survey of Queensland

Black Sea QLD Toolebuc Look-alike

