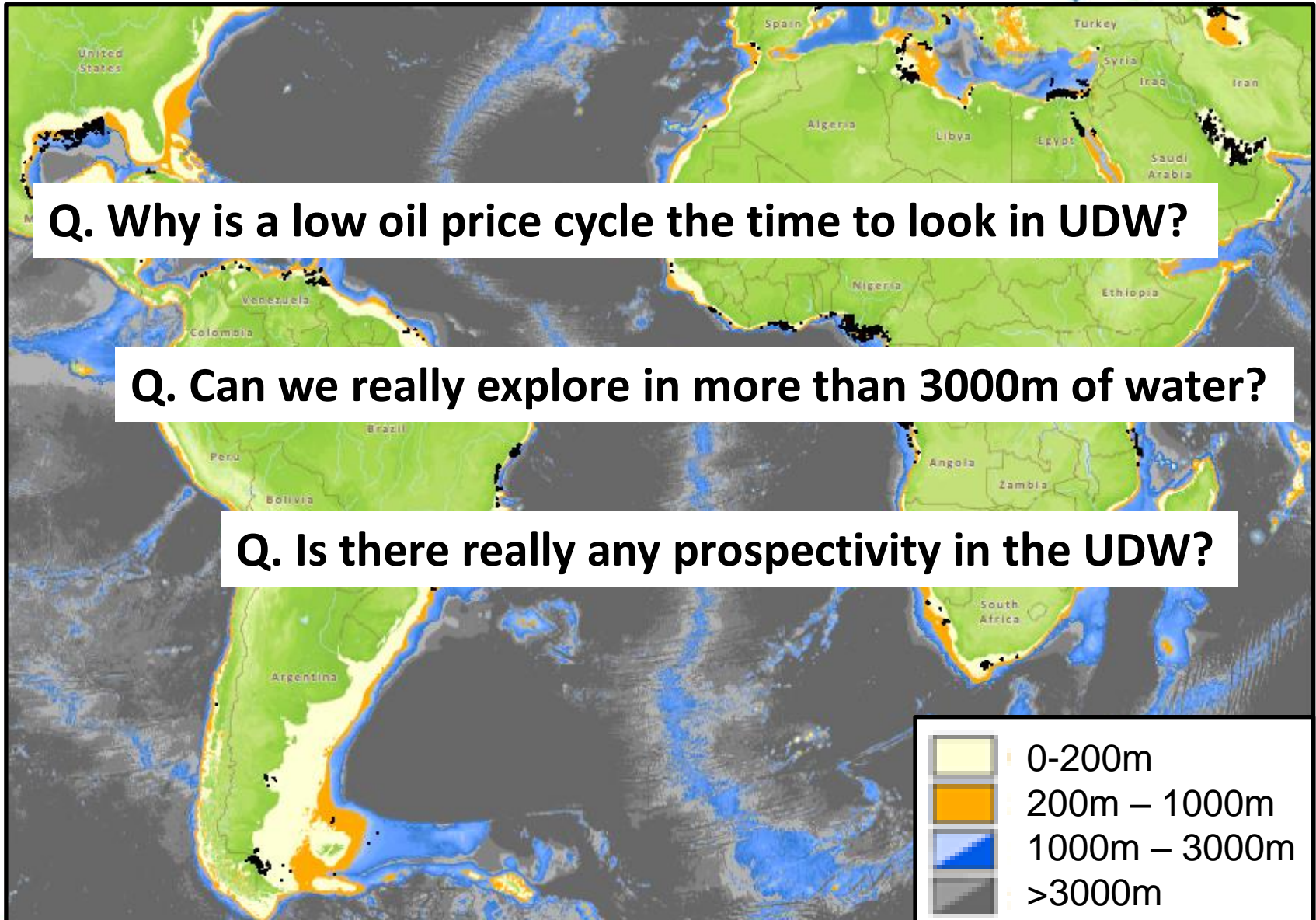


Ultra-Deep water: 3000m “grey zone”



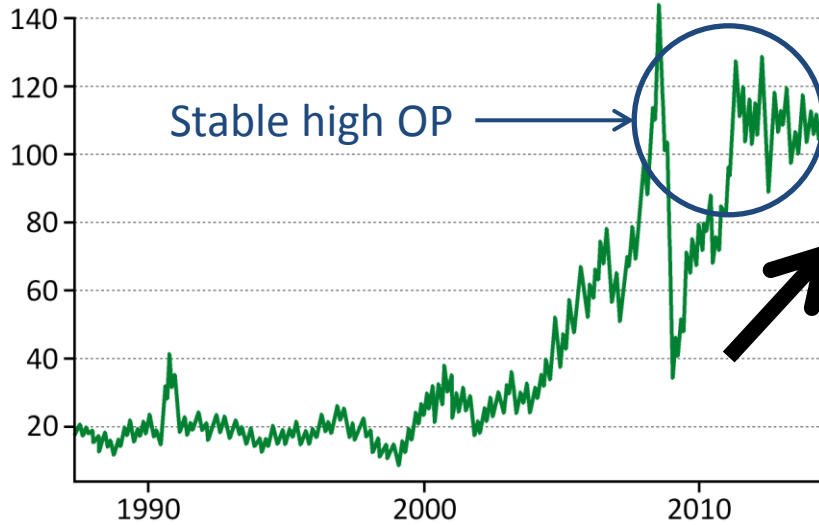
Q. Why is a low oil price cycle the time to look in UDW?

Q. Can we really explore in more than 3000m of water?

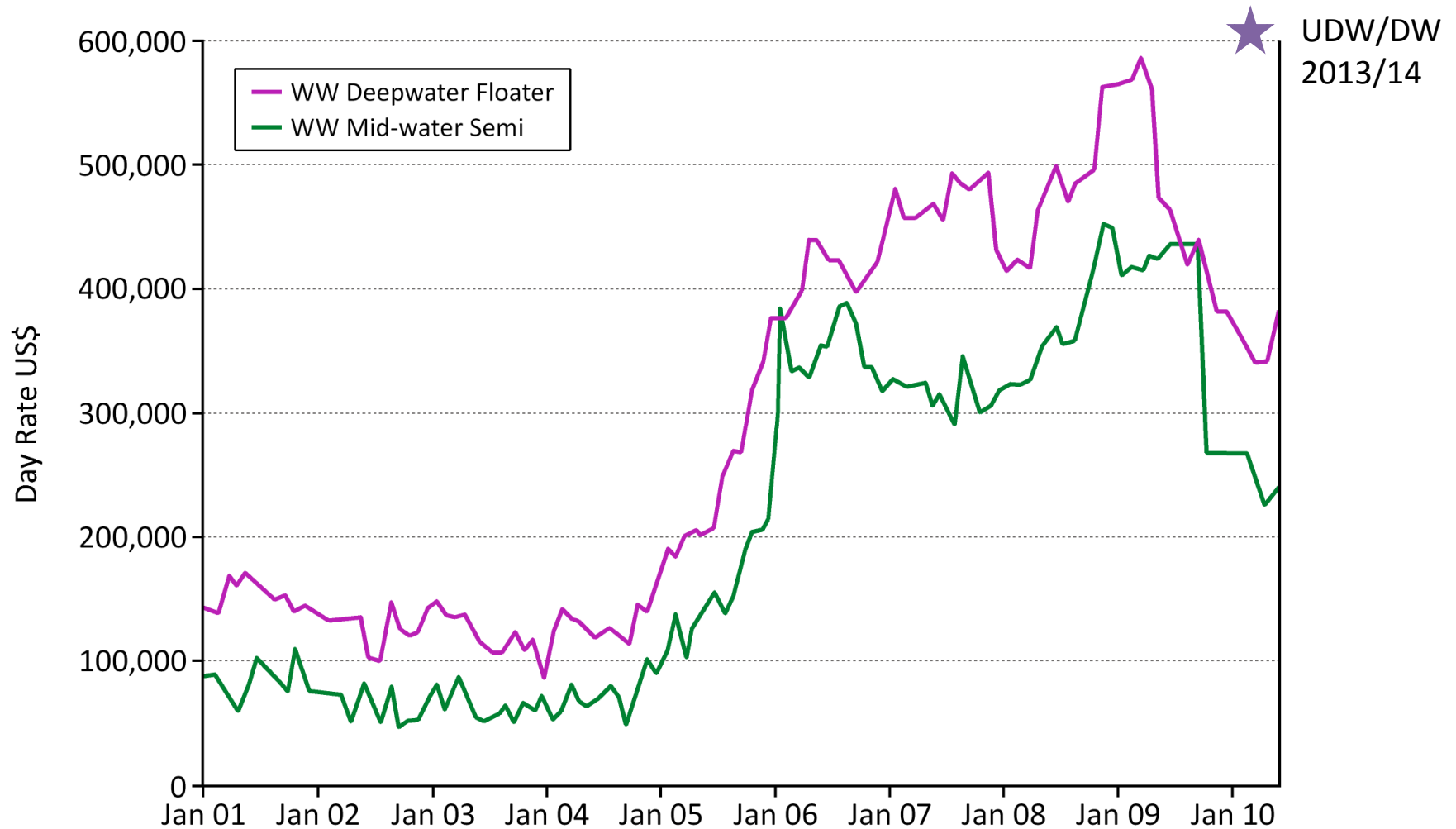
Q. Is there really any prospectivity in the UDW?

Why is a low oil price cycle the time to look in deepwater?

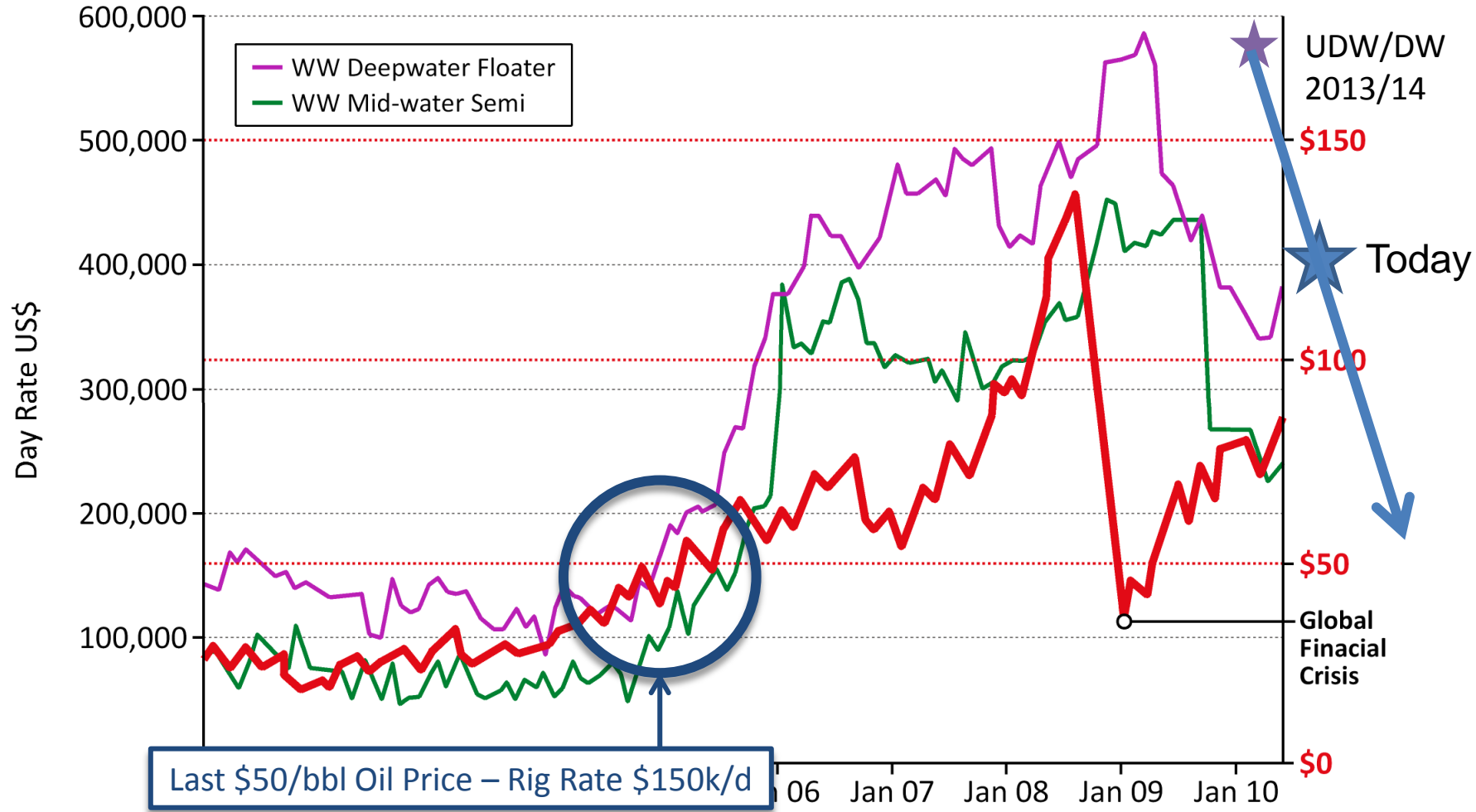
Brent Crude Price in USD



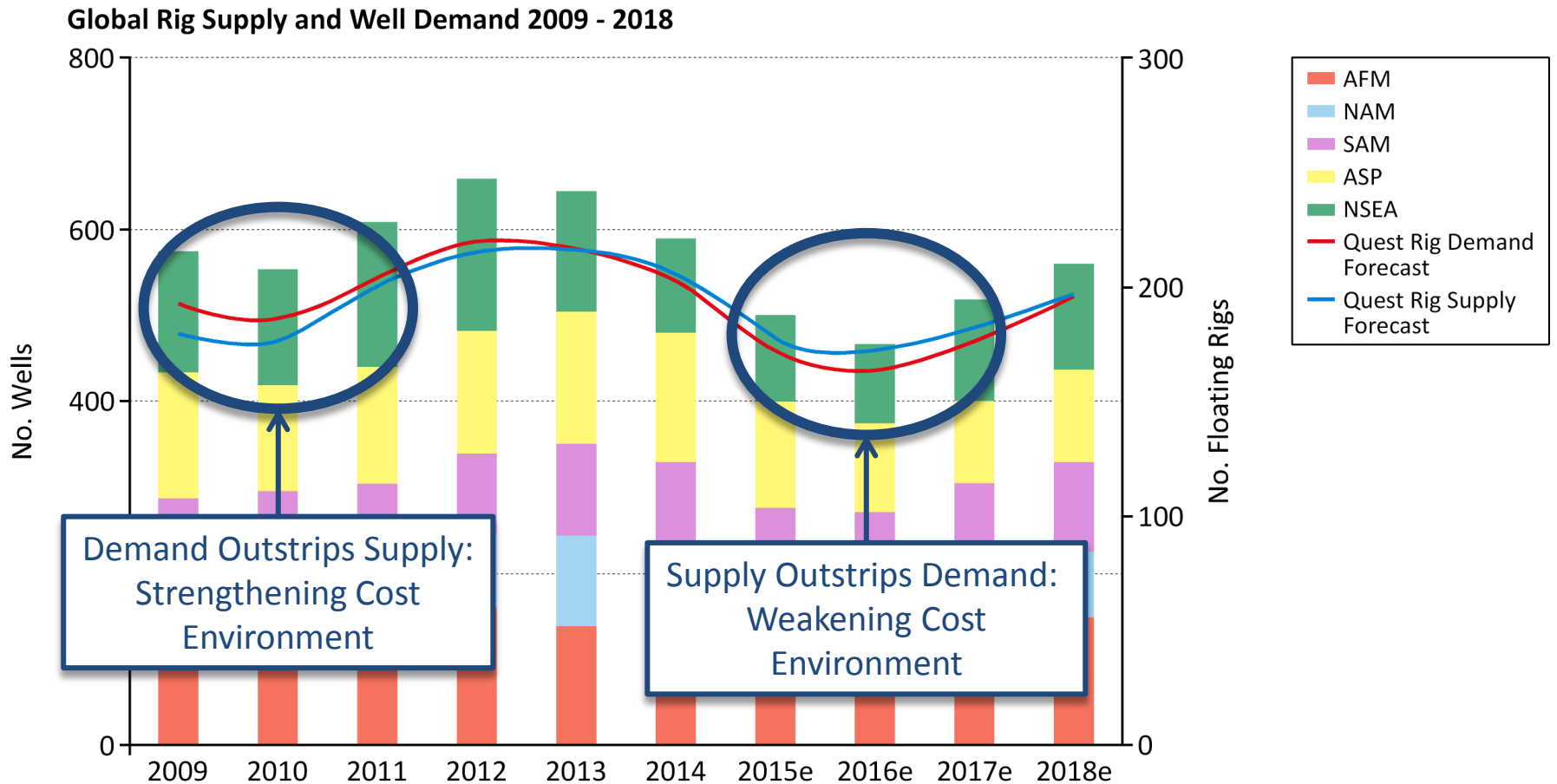
Supply & Demand: Rig Day Rate 2001-2010



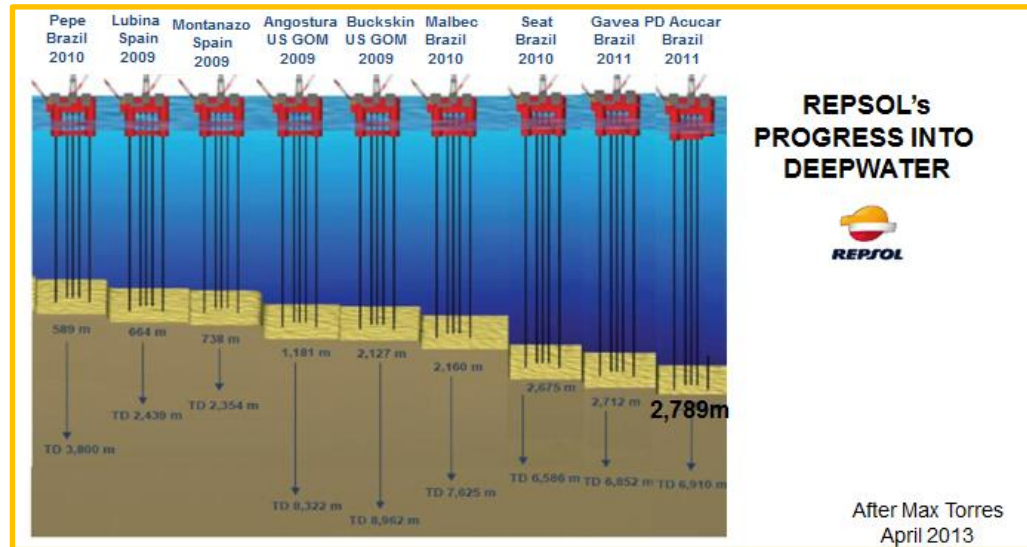
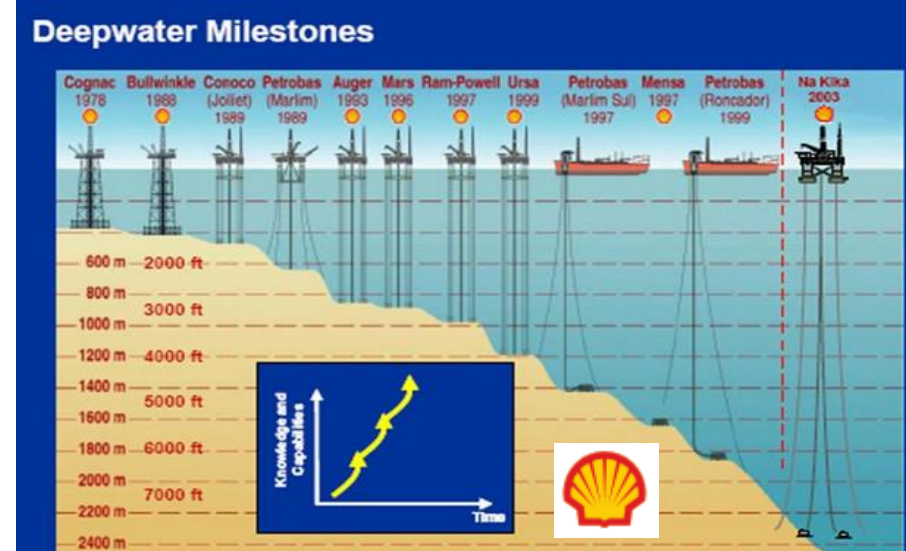
Supply and Demand: Rig Day Rate 2001-2010



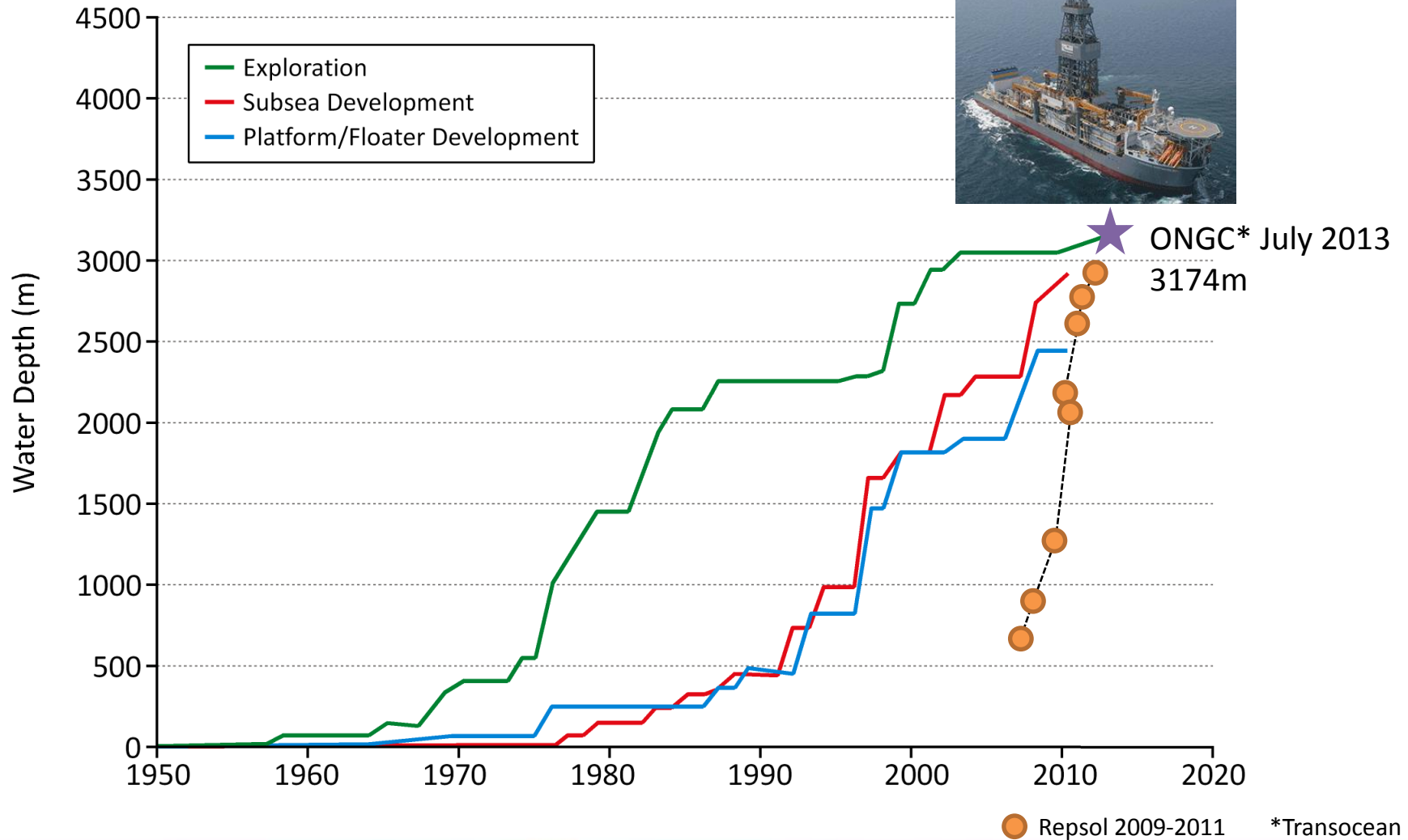
Rig supply/demand forecast: Deep Water Drilling



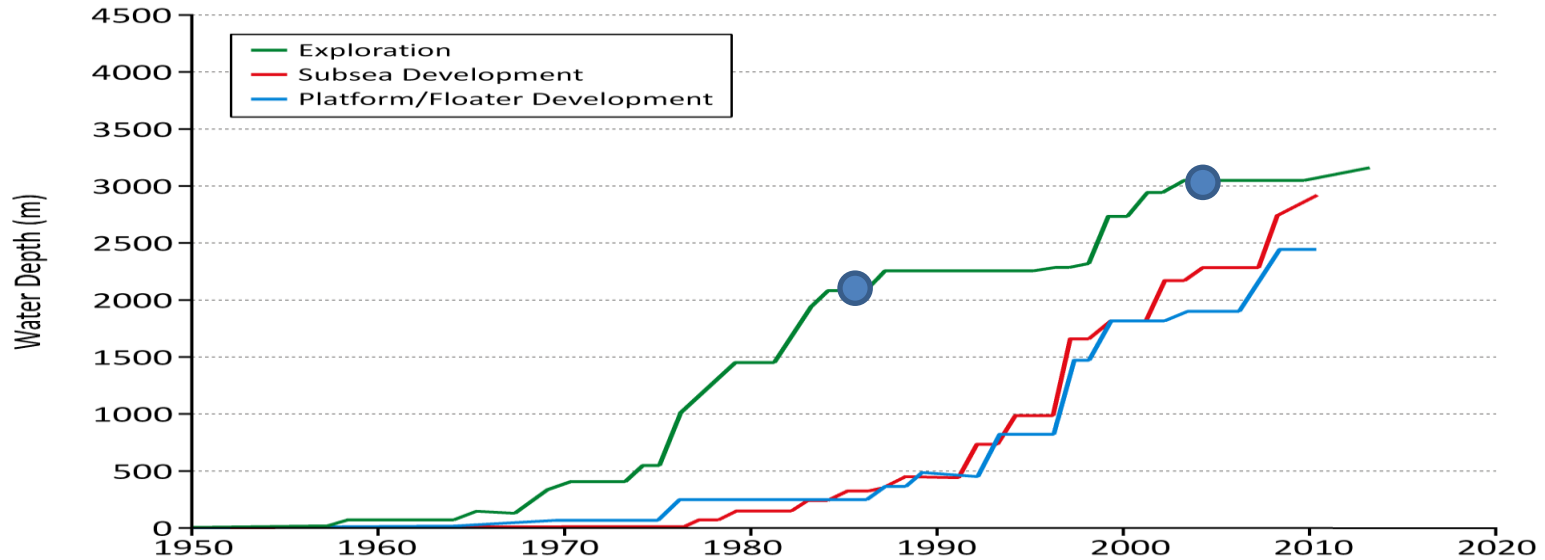
2. Can we really explore in more than 3000m of water?



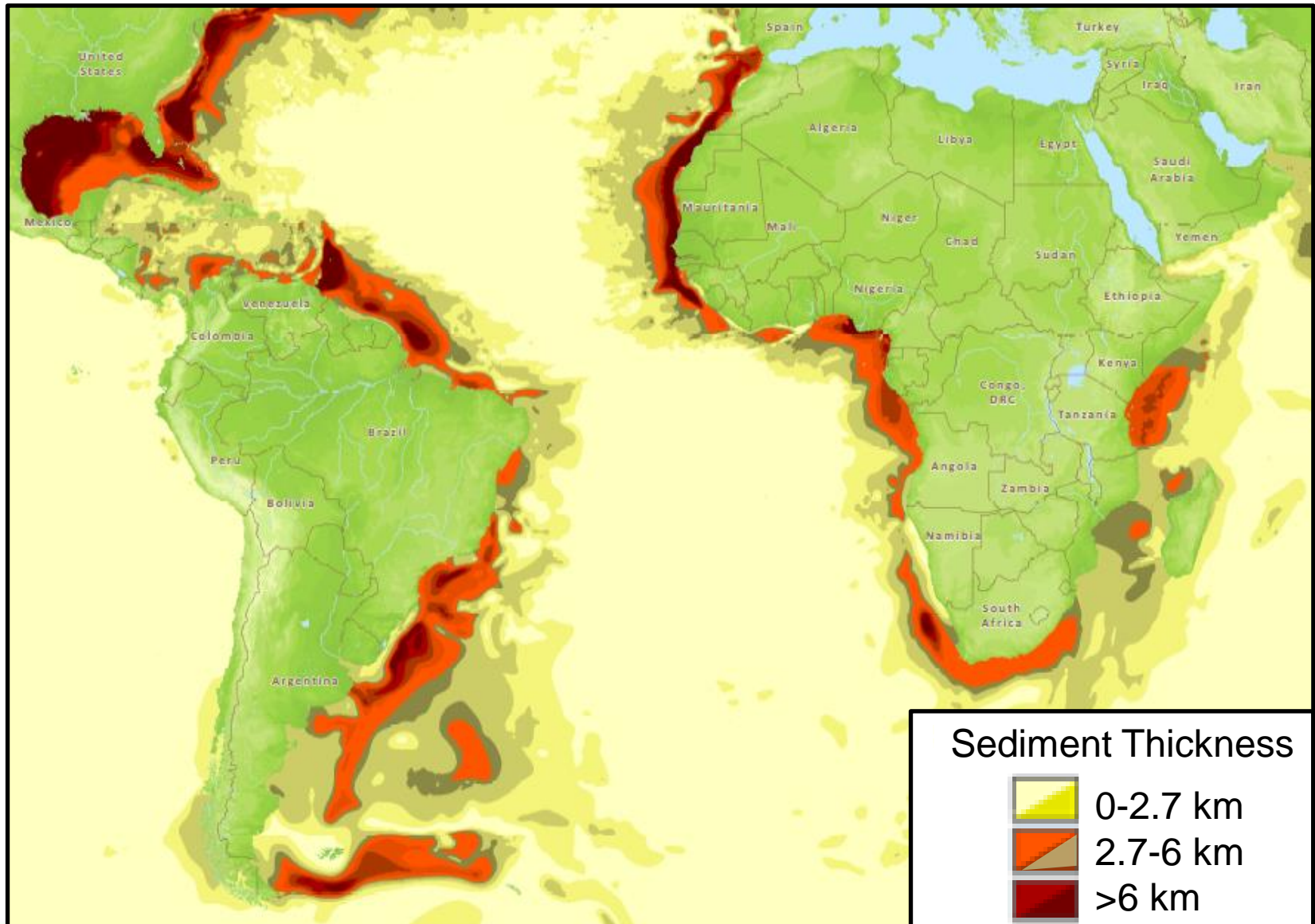
Worldwide progression of water depth capabilities for offshore drilling and production



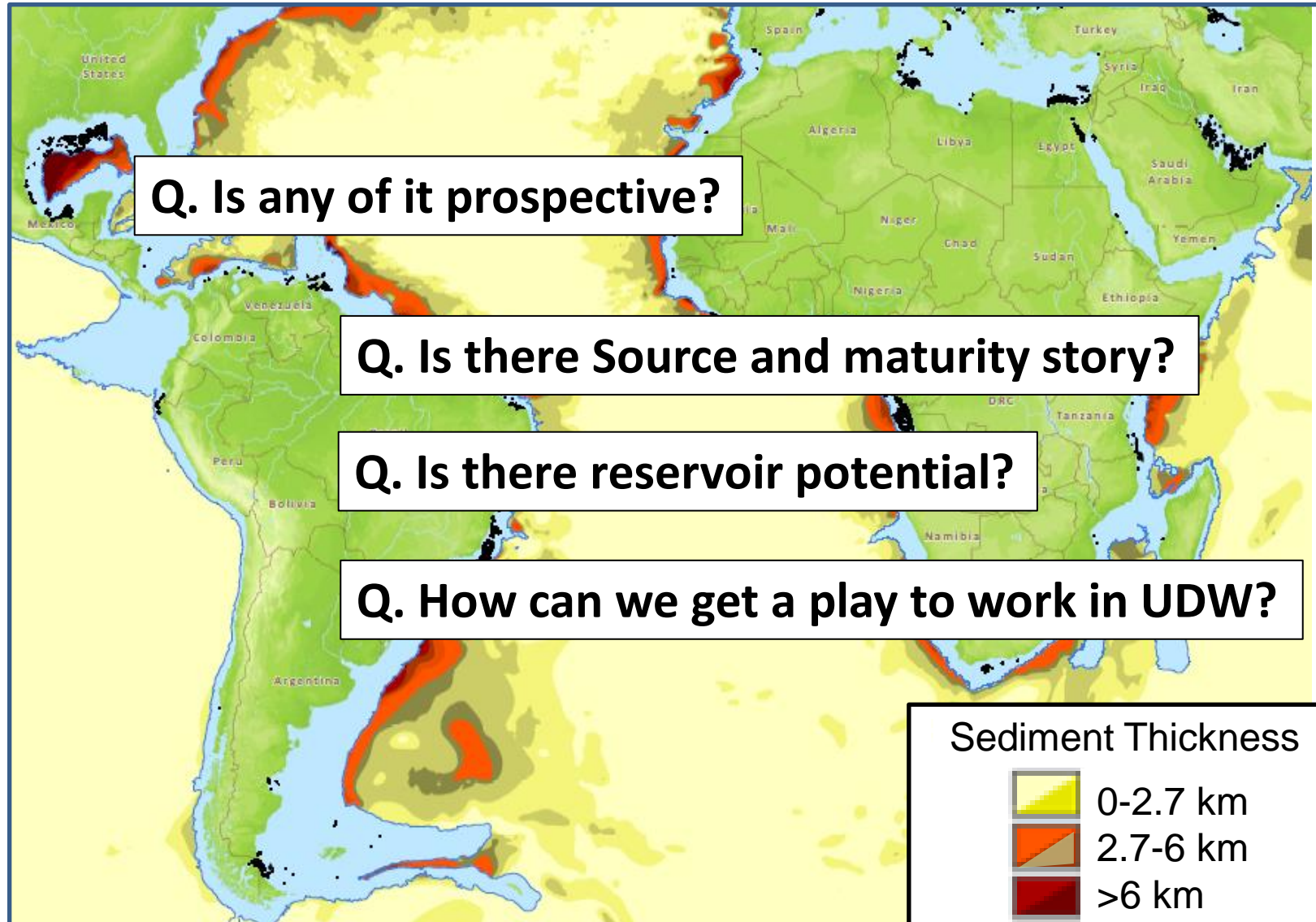
Is high Oil price a pre-requisite for water depth access?



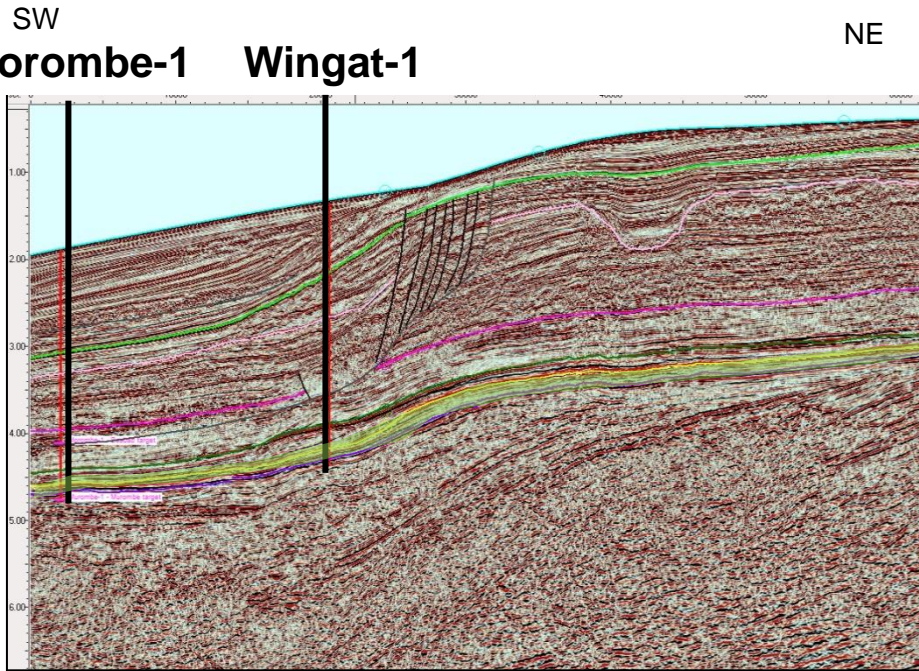
3. Is there really any prospectivity in the UDW?



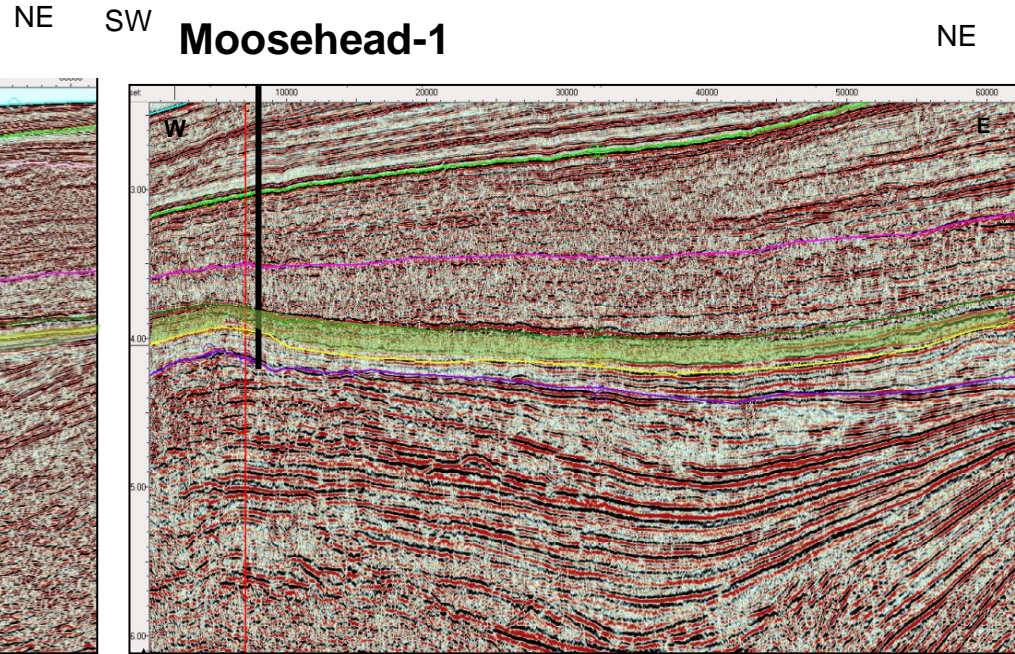
Sediment packages beyond 3000m water



Namibia Proven Aptian Source

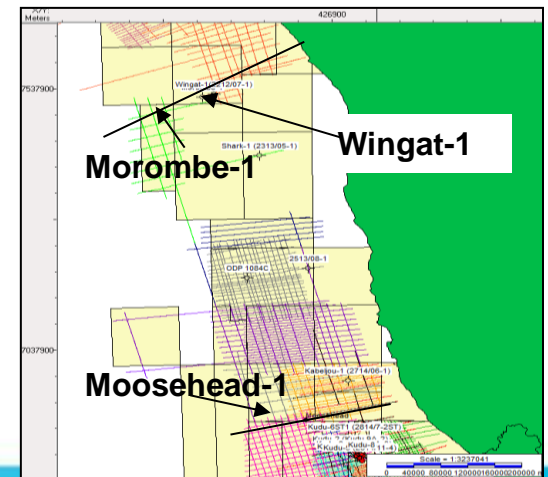


Line 108 Km

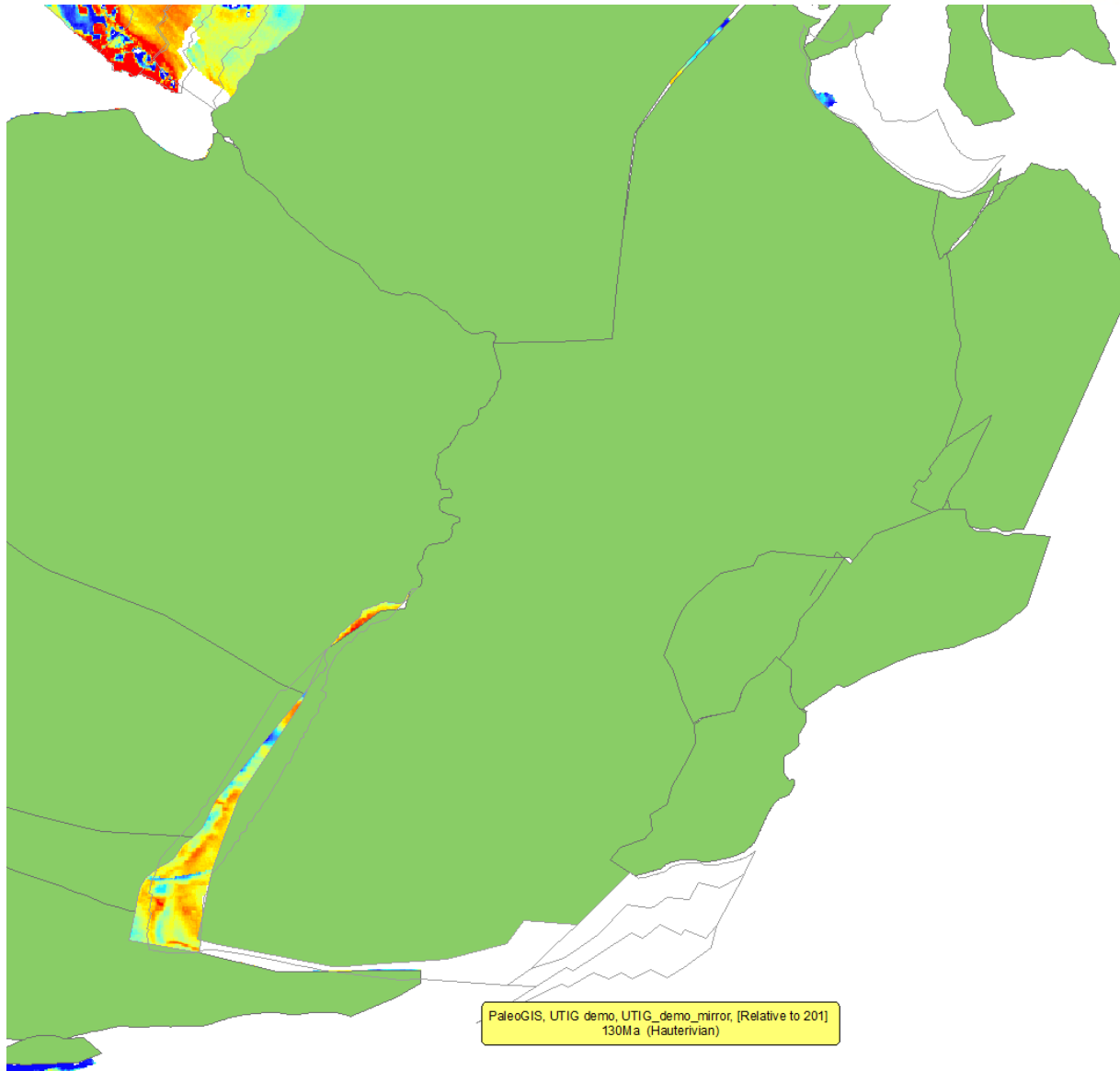


Line 91 Km

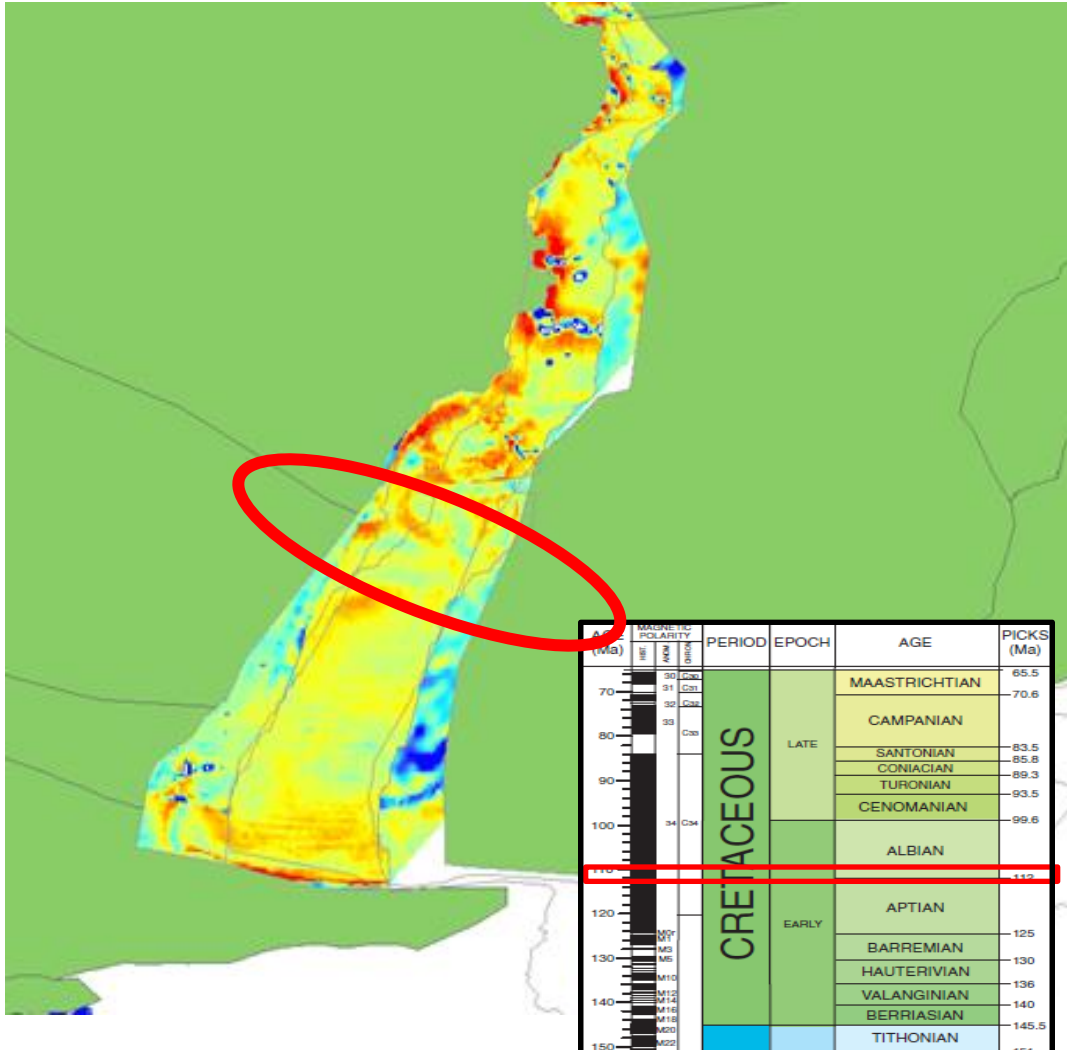
- **Three HRT wells 2013/14 in NAMIBIA confirm Aptian source rocks. Light oil recovered.**
- **HRT's wells DERISKED the deepwater Namibian play for source.**



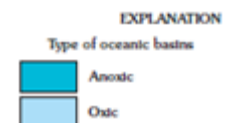
Start at the beginning: Opening of the South Atlantic.



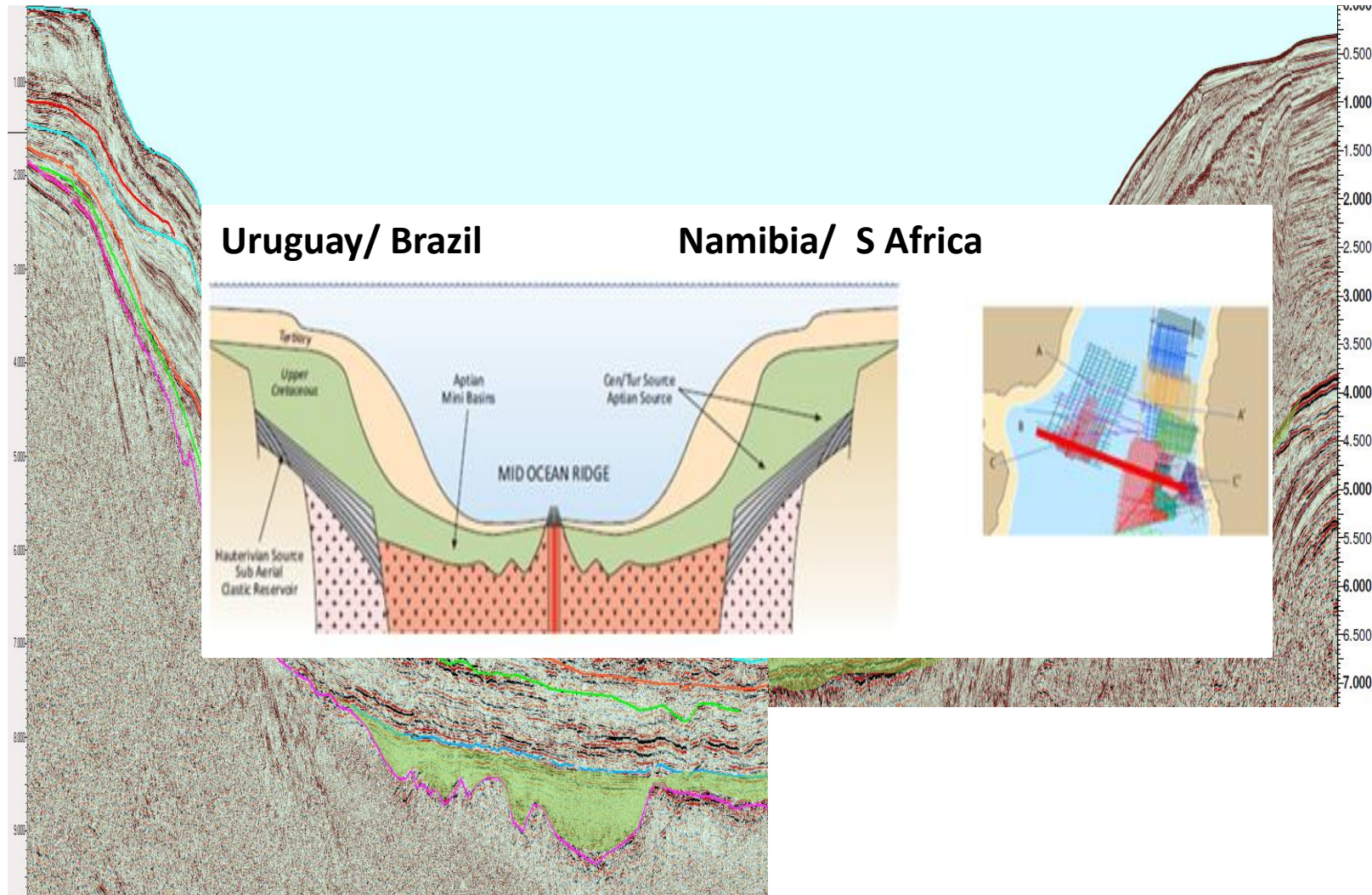
Early Cretaceous Drift Basin: Ubiquitous Aptian Source Rock



USGS 2006 after Tissot 1980



UDW Uruguay: UDW Namibia



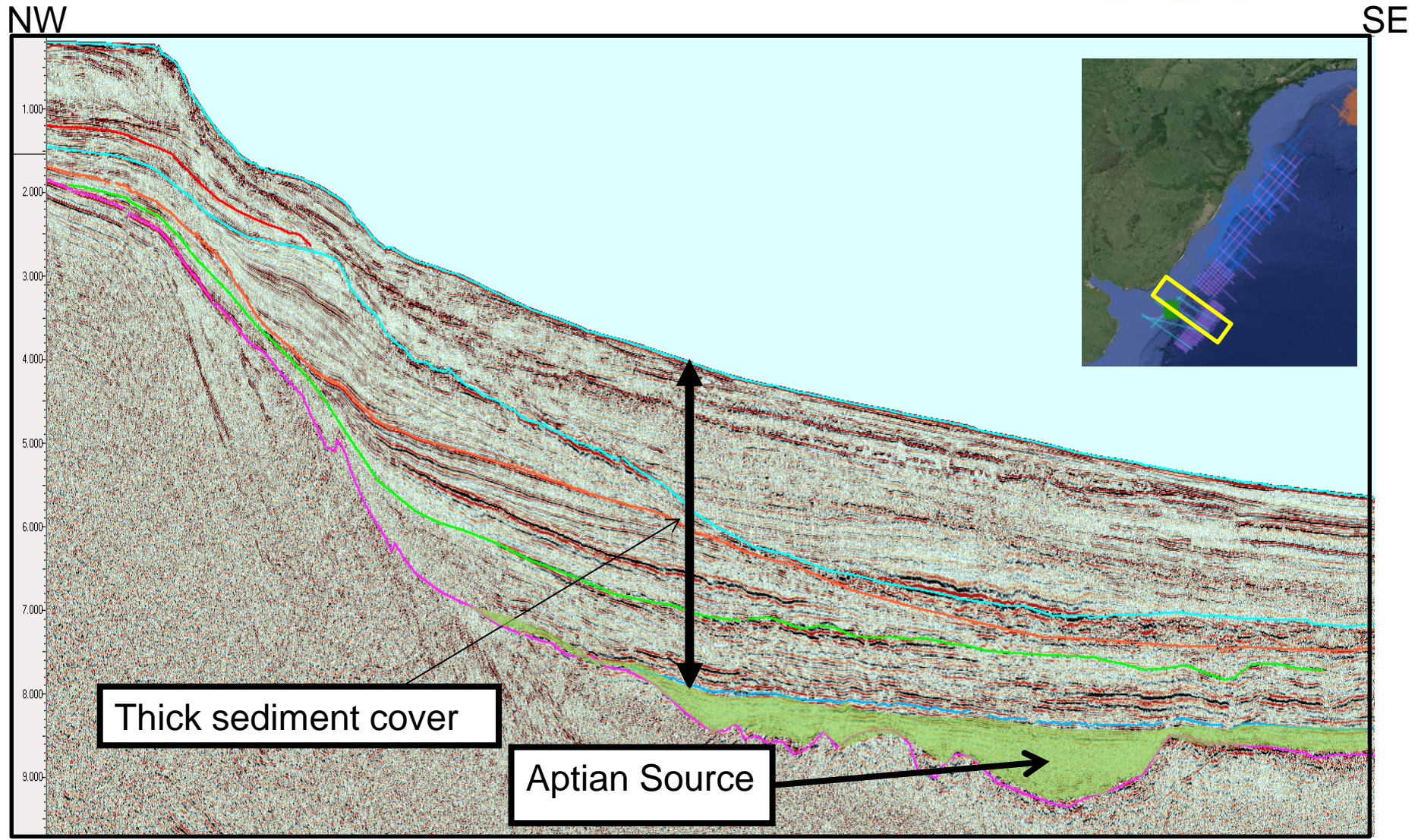
TWT
PSTM

PSTM

Line length 248 km

Line length 221 km

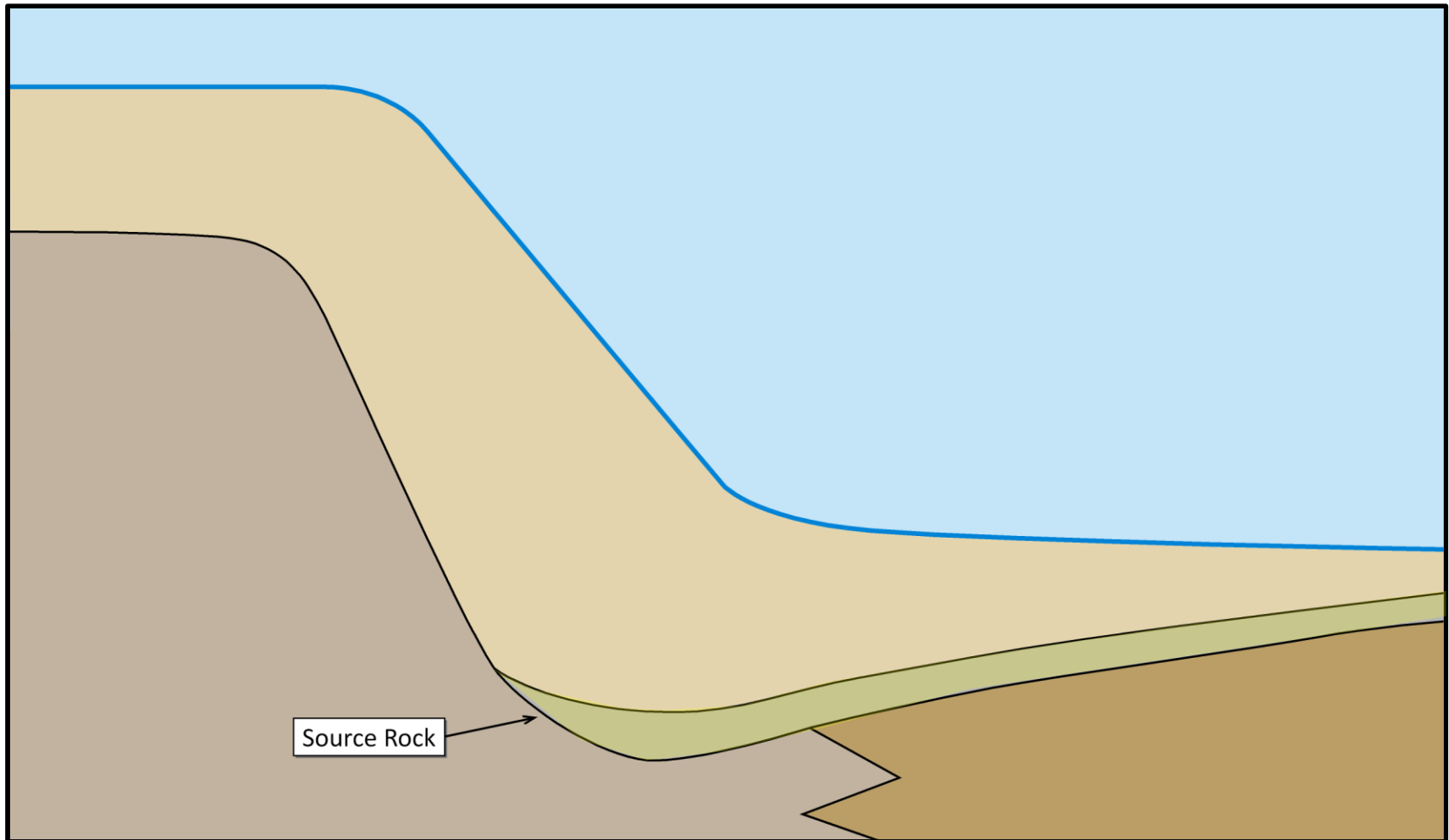
Ultra Deep-Water Uruguay



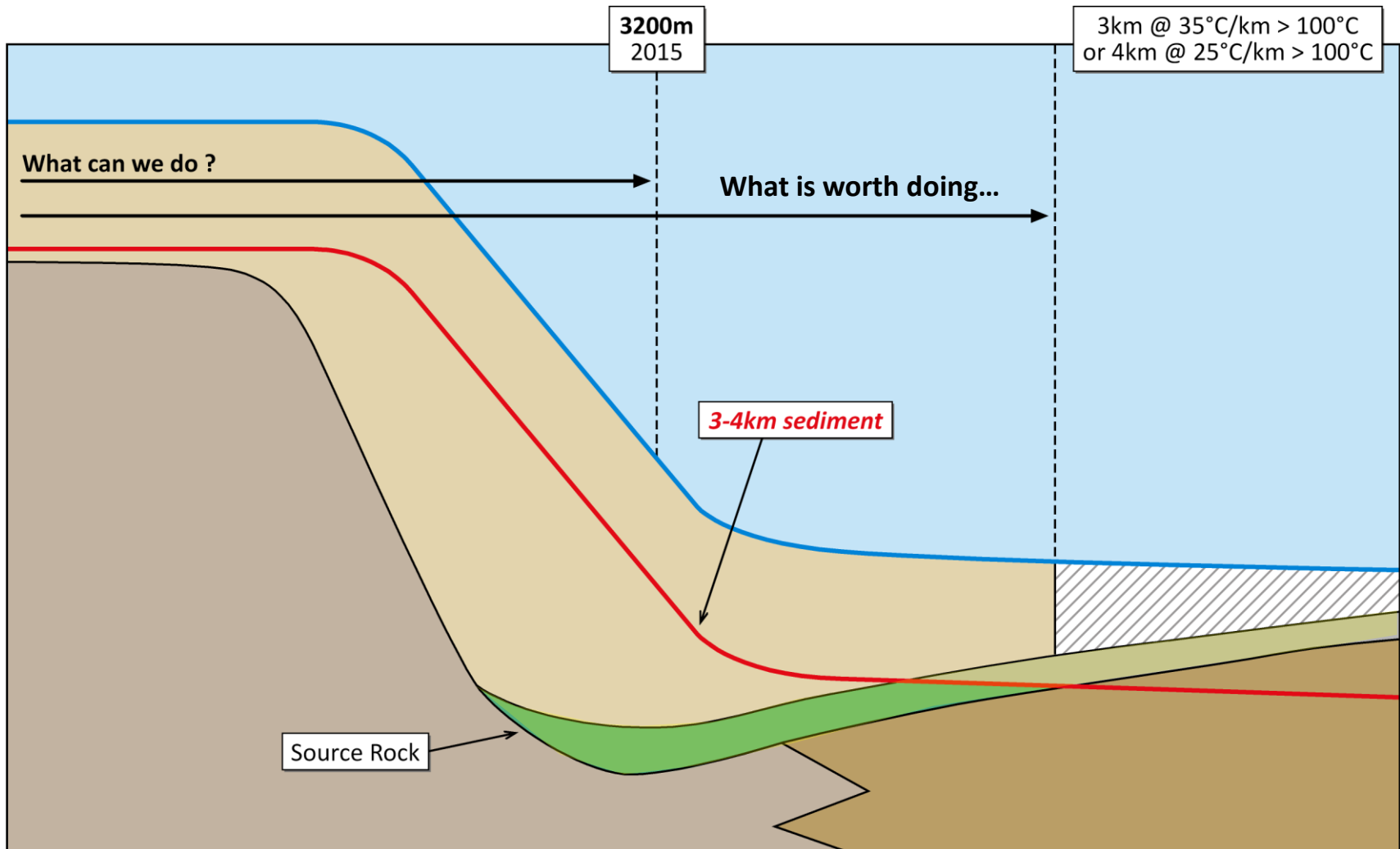
PSTM

Line length 248km

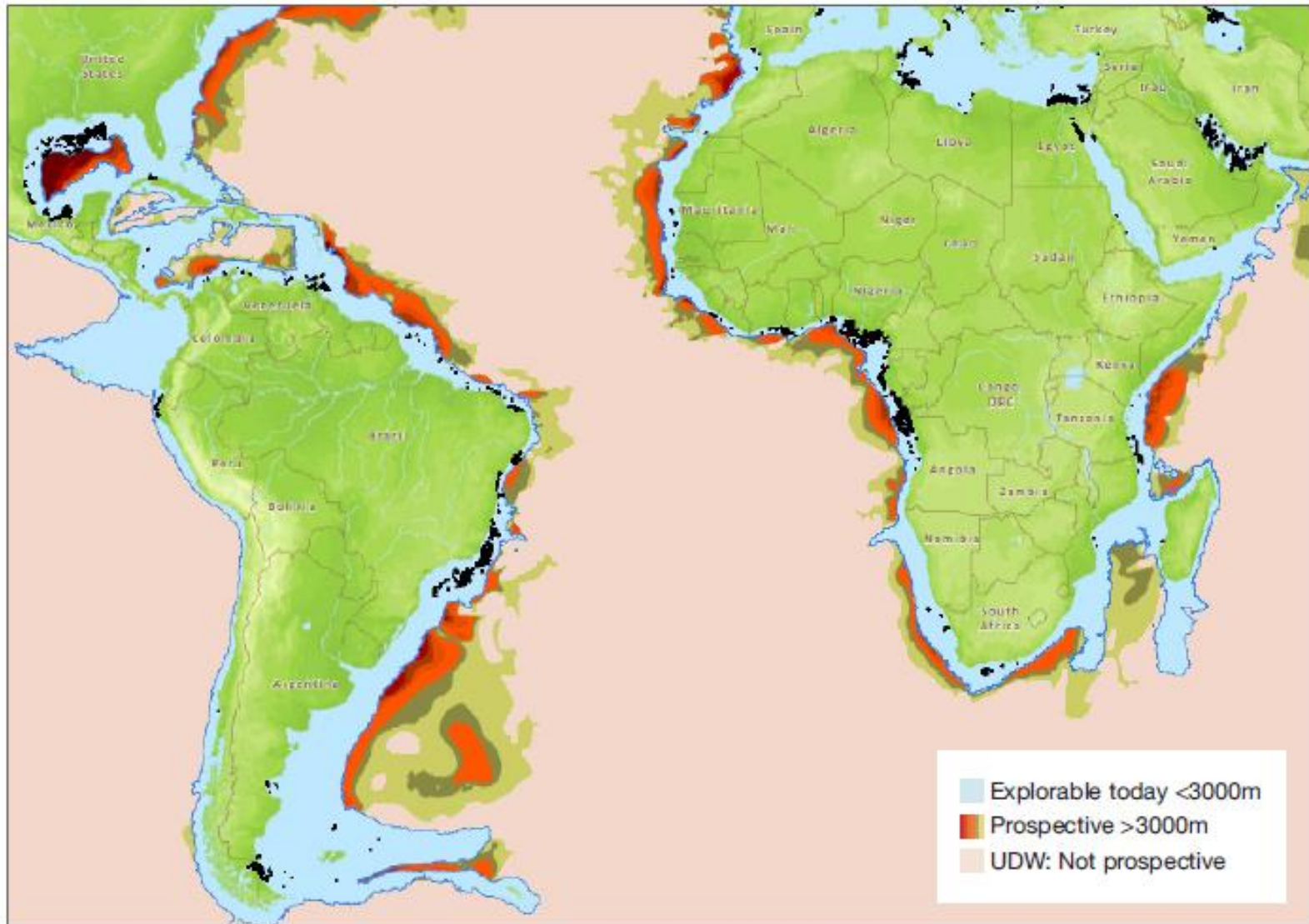
How far out in UDW are there the elements of a HC system?



How far out in UDW are there the elements of a HC system?

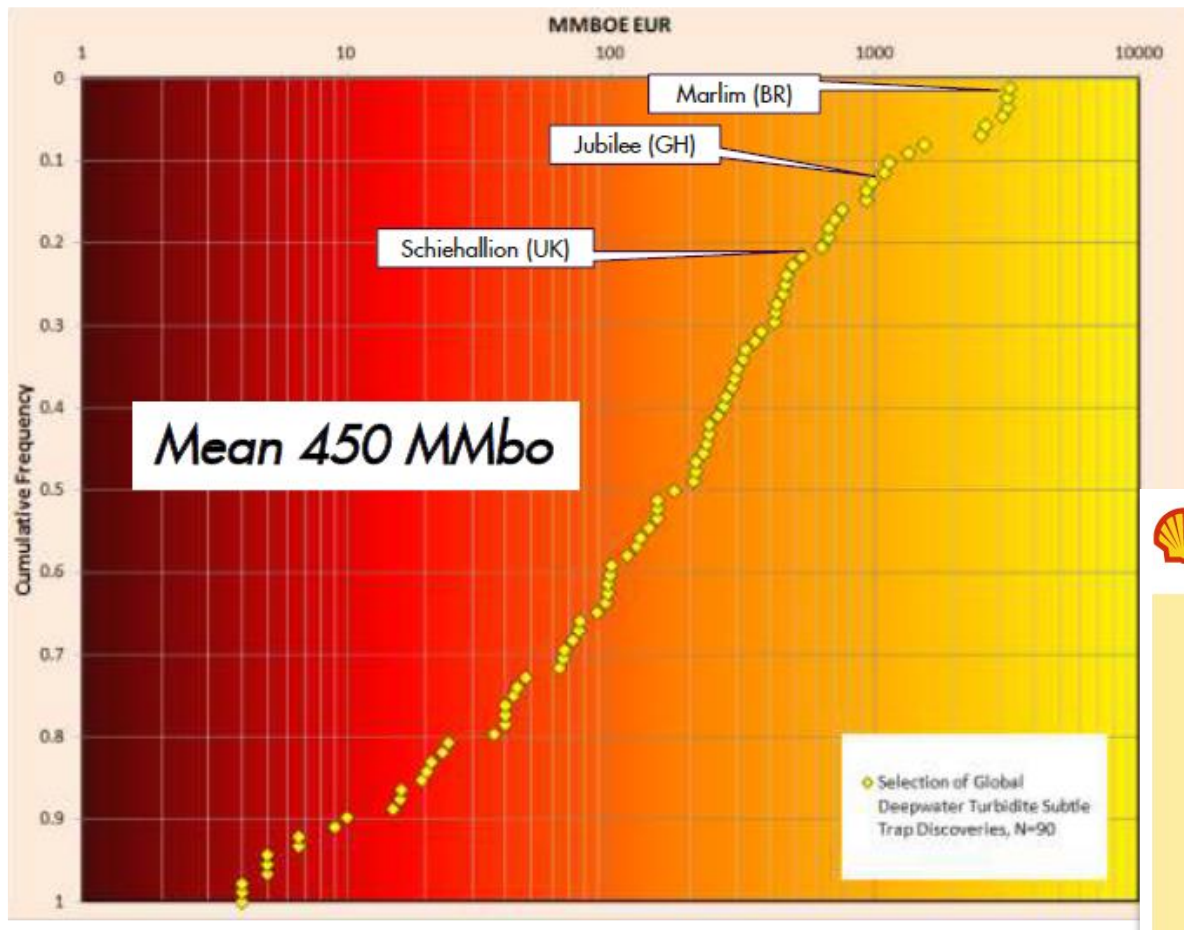


What we can do – and what we need to do...



Q. But is there reservoir story in UDW?

Play Analysis: Deepwater Subtle Traps



Studied 86 Deepwater Discoveries in Atlantic and North Sea Basins

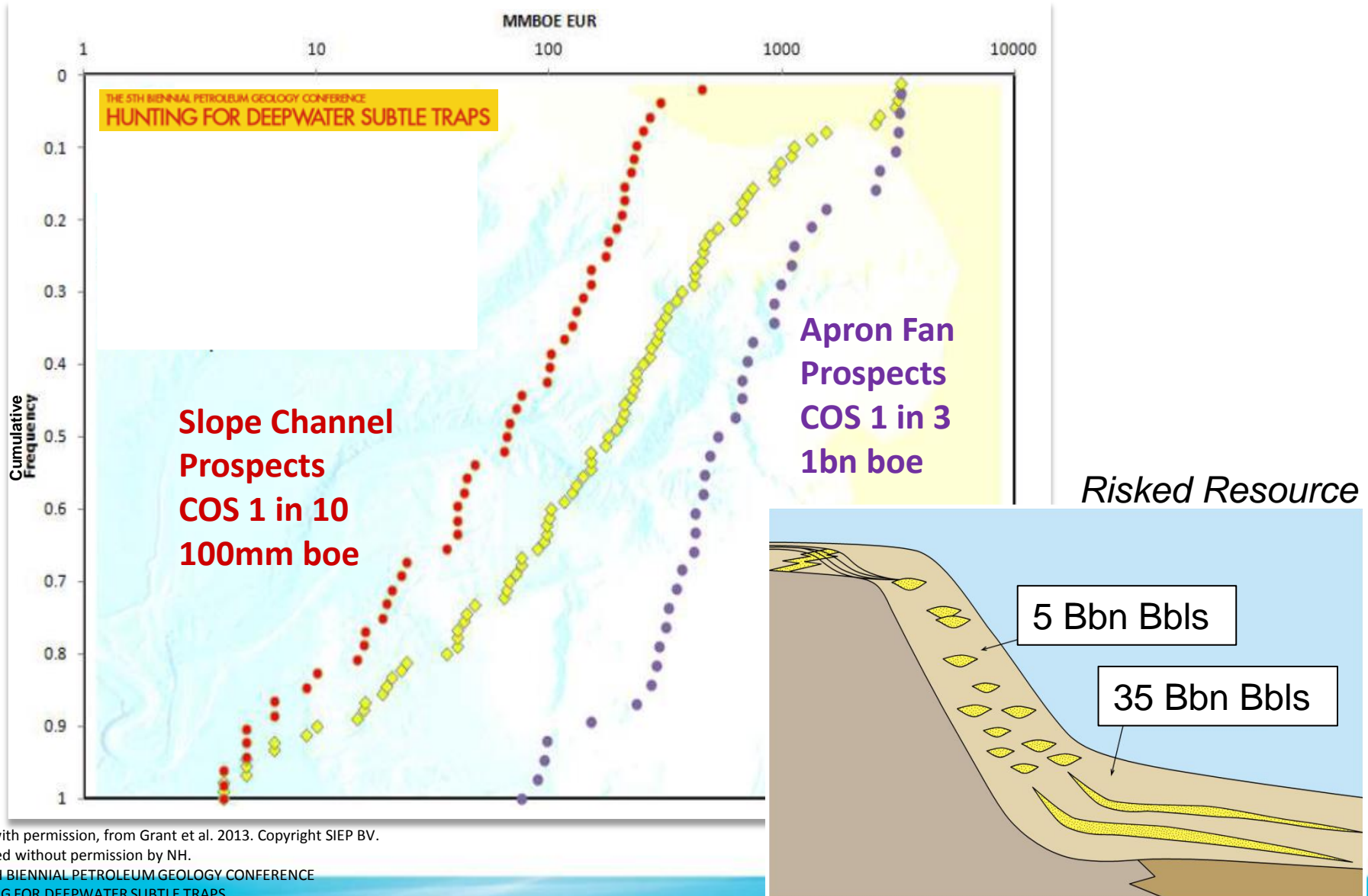


THE 5TH BIENNIAL PETROLEUM GEOLOGY CONFERENCE
HUNTING FOR DEEPWATER SUBTLE TRAPS
 From Geology to Technology (and back to Geology....)

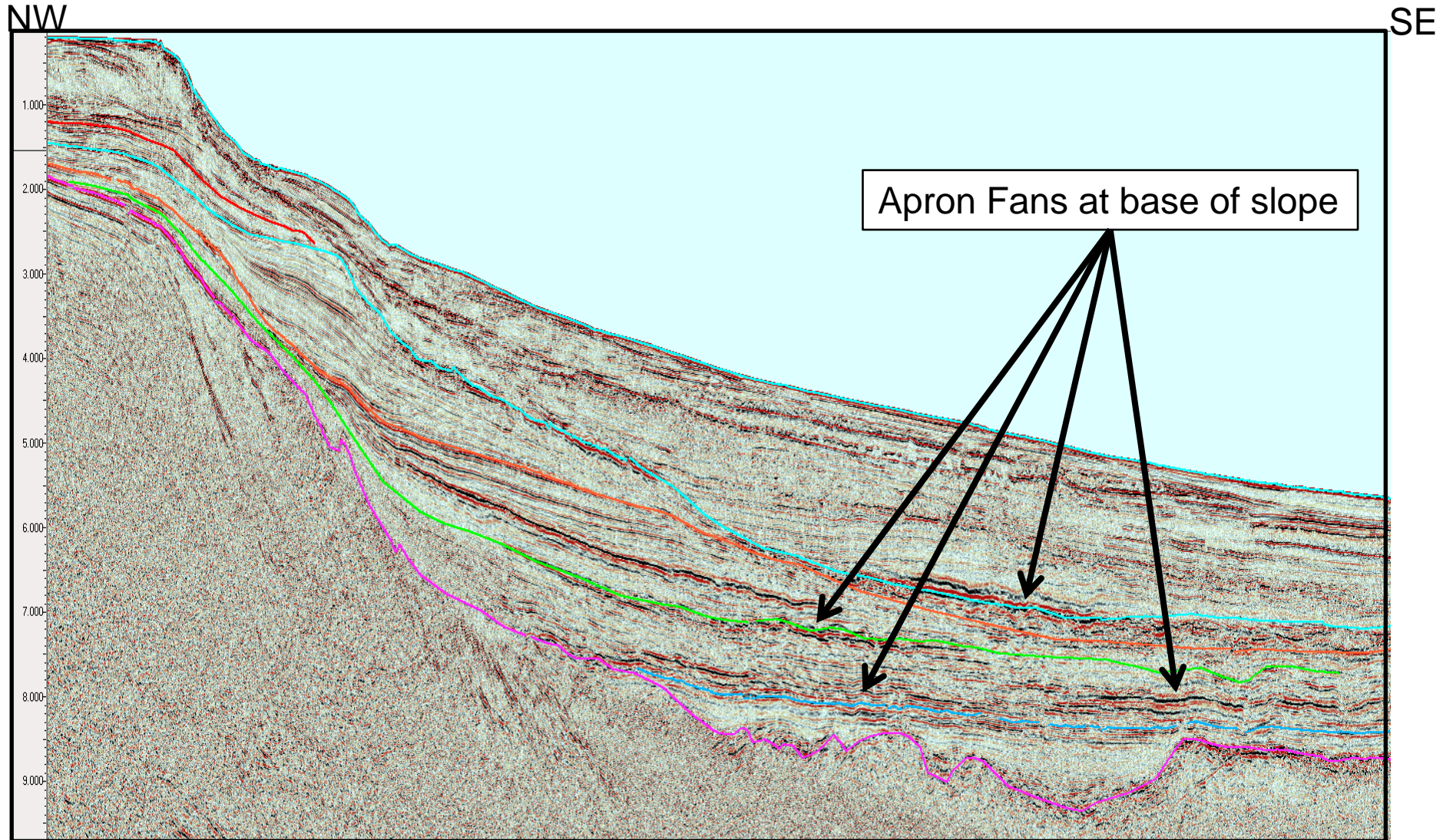


Colin J. Grant, Francesco Menapace, Uisdean Nicholson, Dominic McCormick, Garán O'Byrne, Gabriel Guerra & Jim Pickens

Play Analysis: Slope Canyons vs Apron Fans



Ultra Deep-Water Uruguay

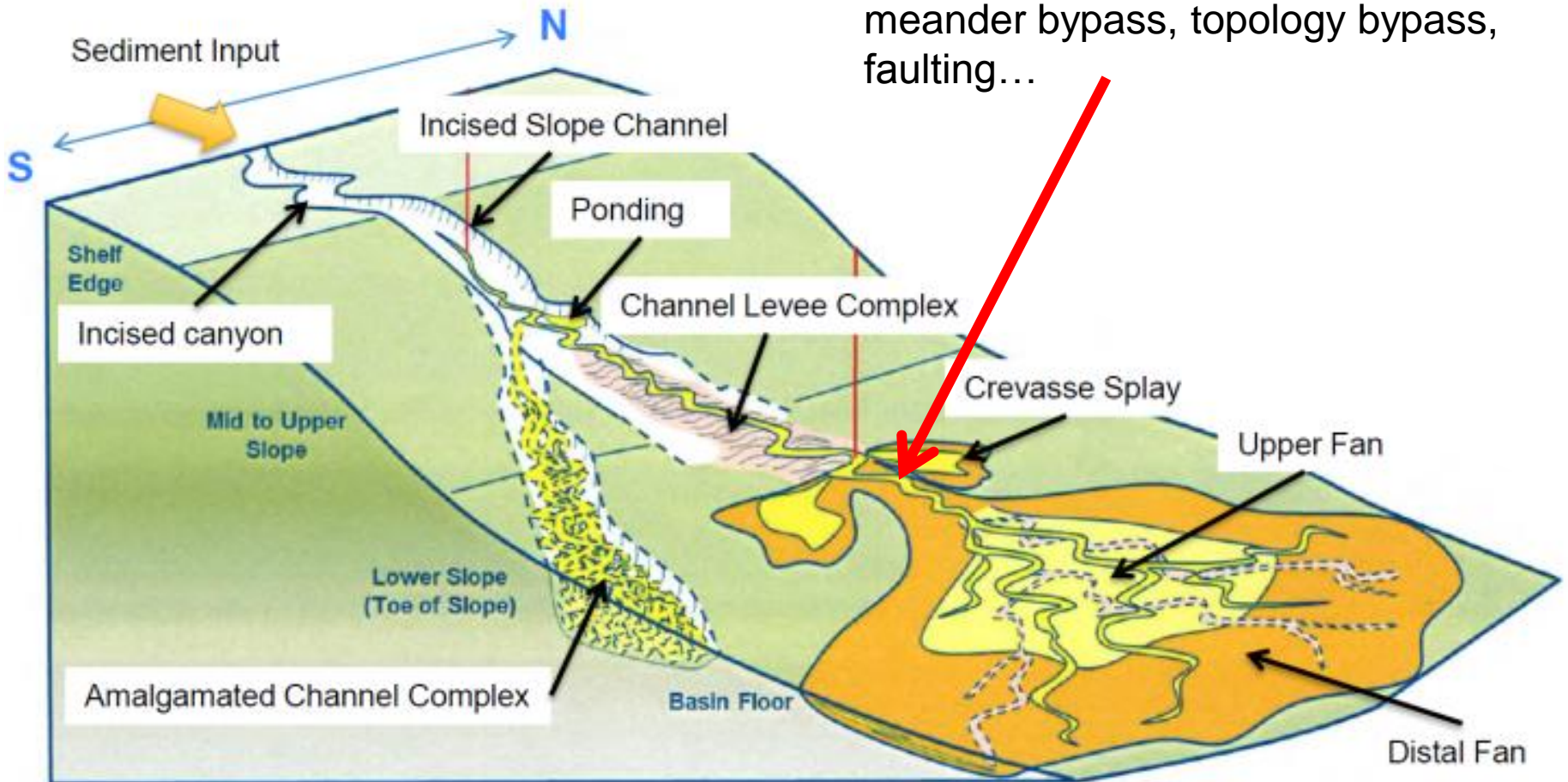


PSTM

Line length 248km

Base of slope apron fan weakness – updip seal

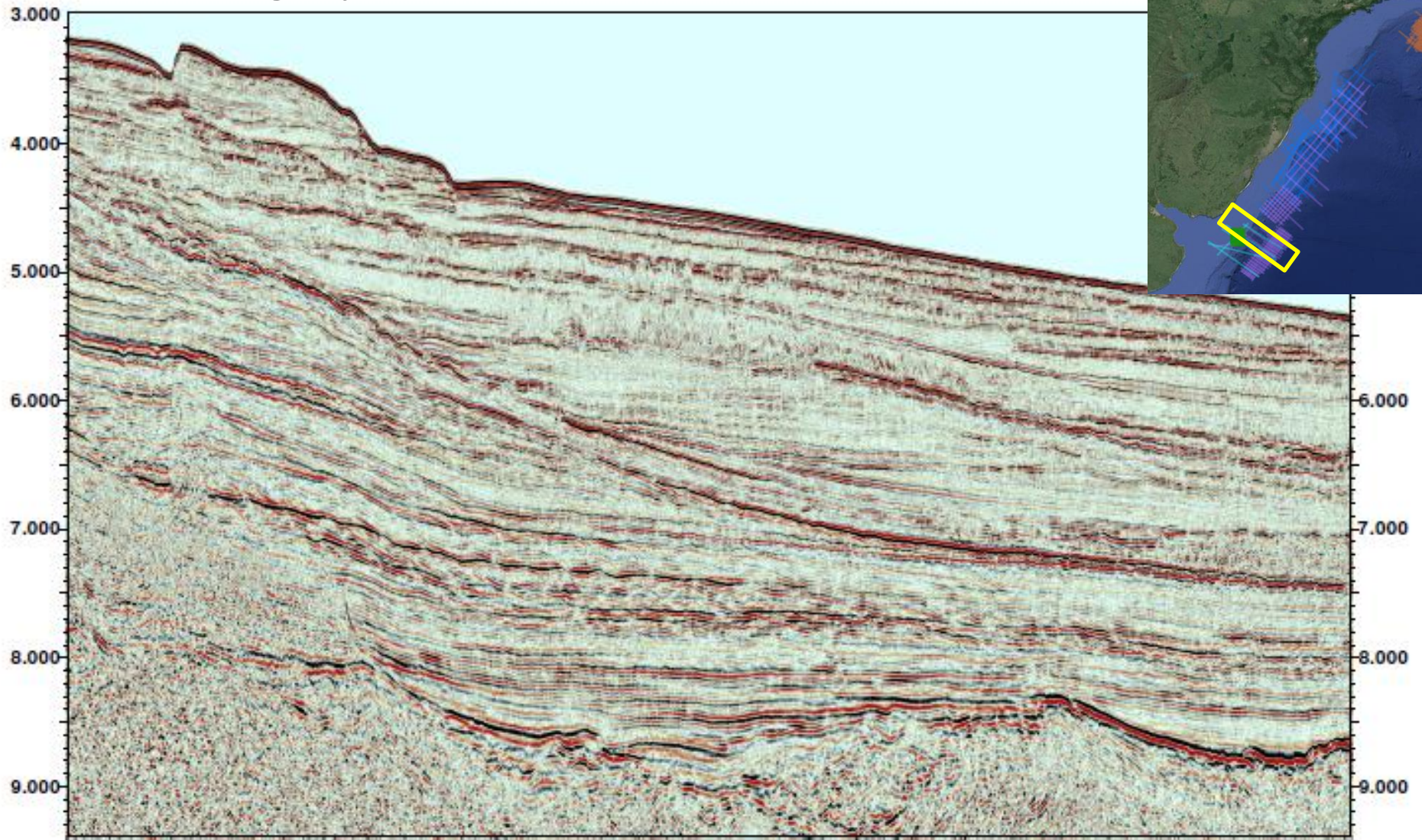
Up-dip trap could be provided by meander bypass, topology bypass, faulting...



Looking for Apron Fans at Base of slope



Uruguay PSTM



TWT

241 km line

Looking for Apron Fans at Base of slope

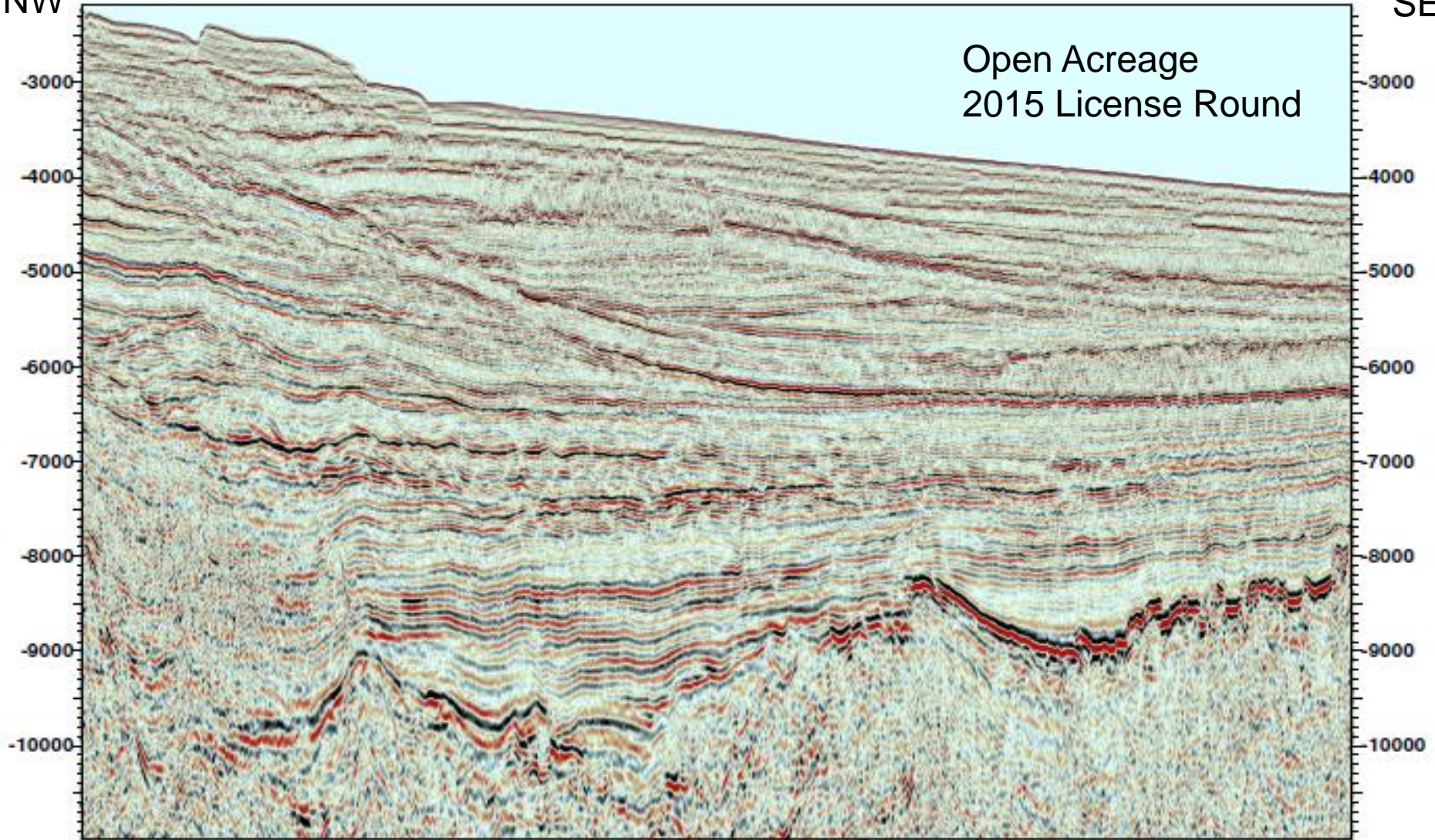
Uruguay PSDM



NW

SE

Open Acreage
2015 License Round



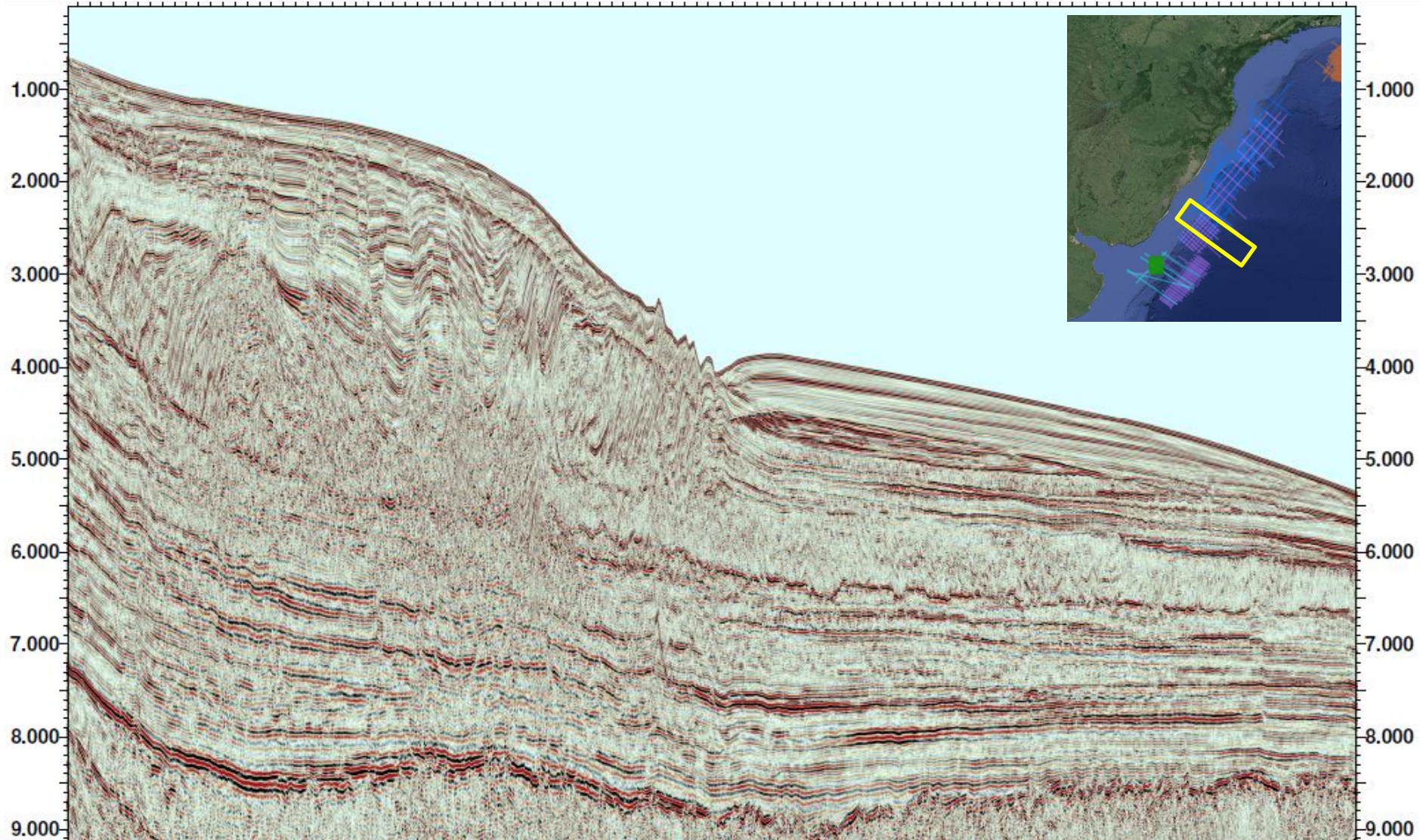
Depth m

241 km line

Looking for Apron Fans at Base of slope



NW South Brazil: Pelotas PSTM SE



TWT

257 km line

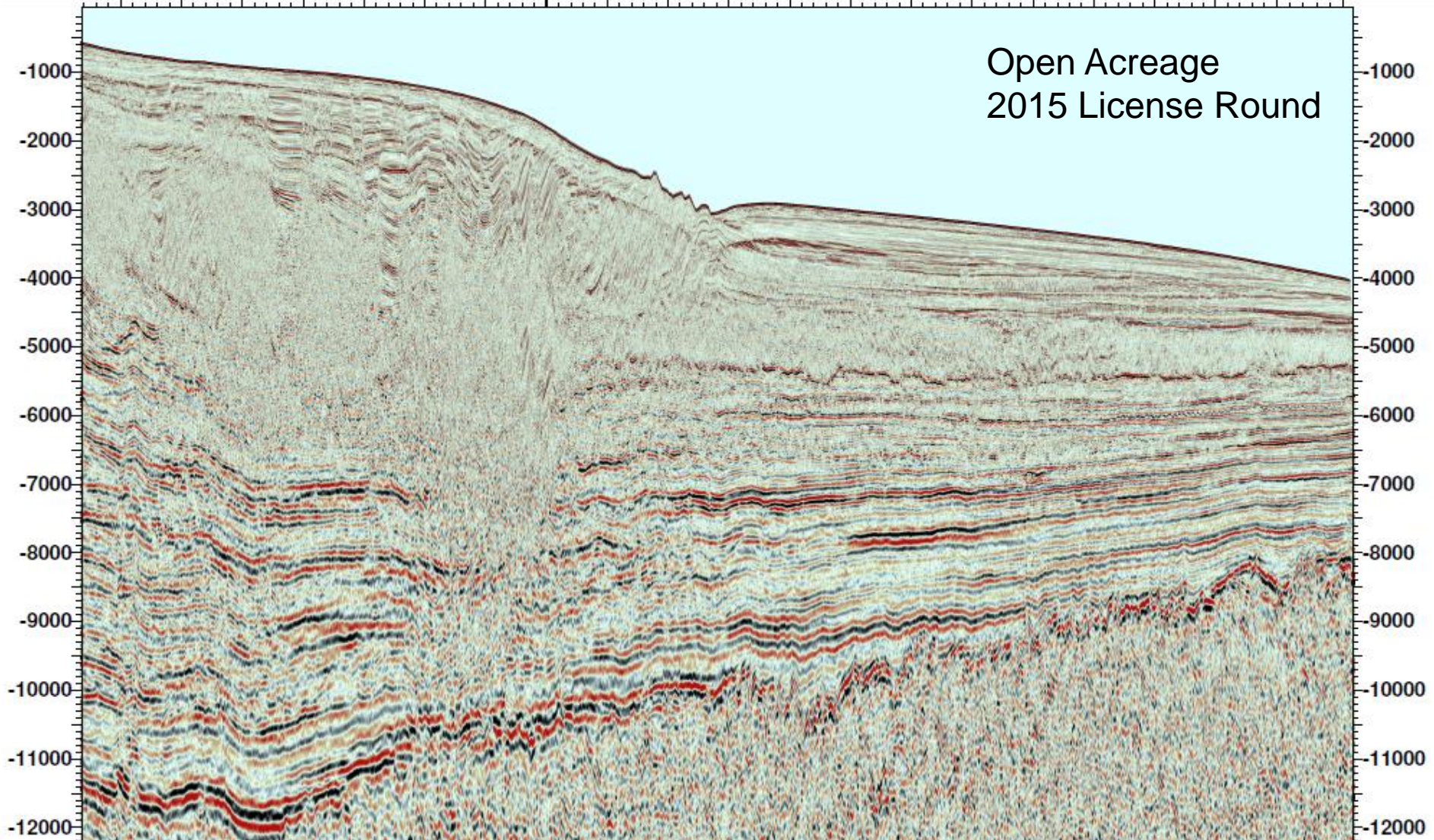
Looking for Apron Fans at Base of slope



NW South Brazil: Pelotas PSDM

SE

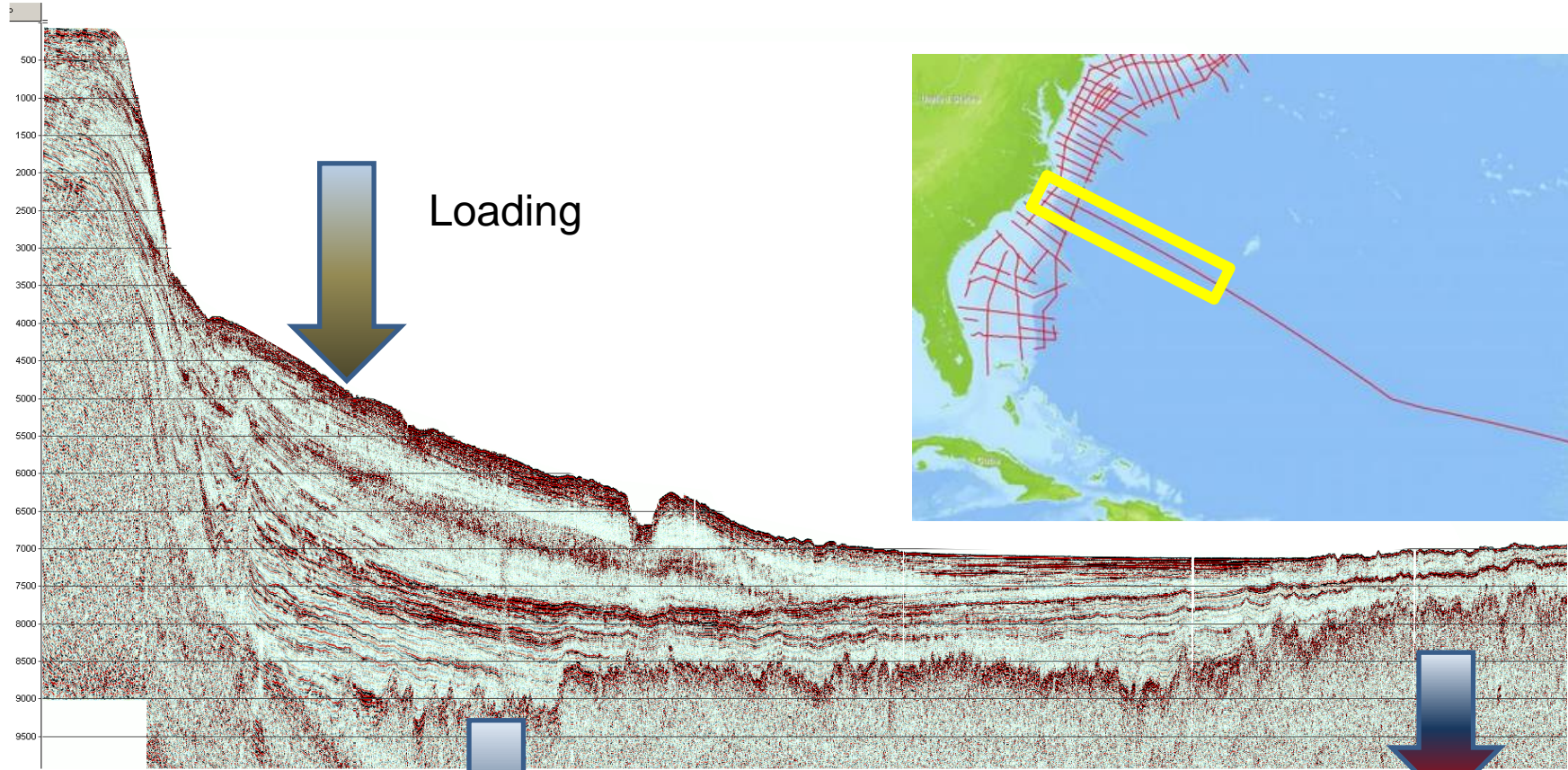
Open Acreage
2015 License Round



Depth m

257 km line

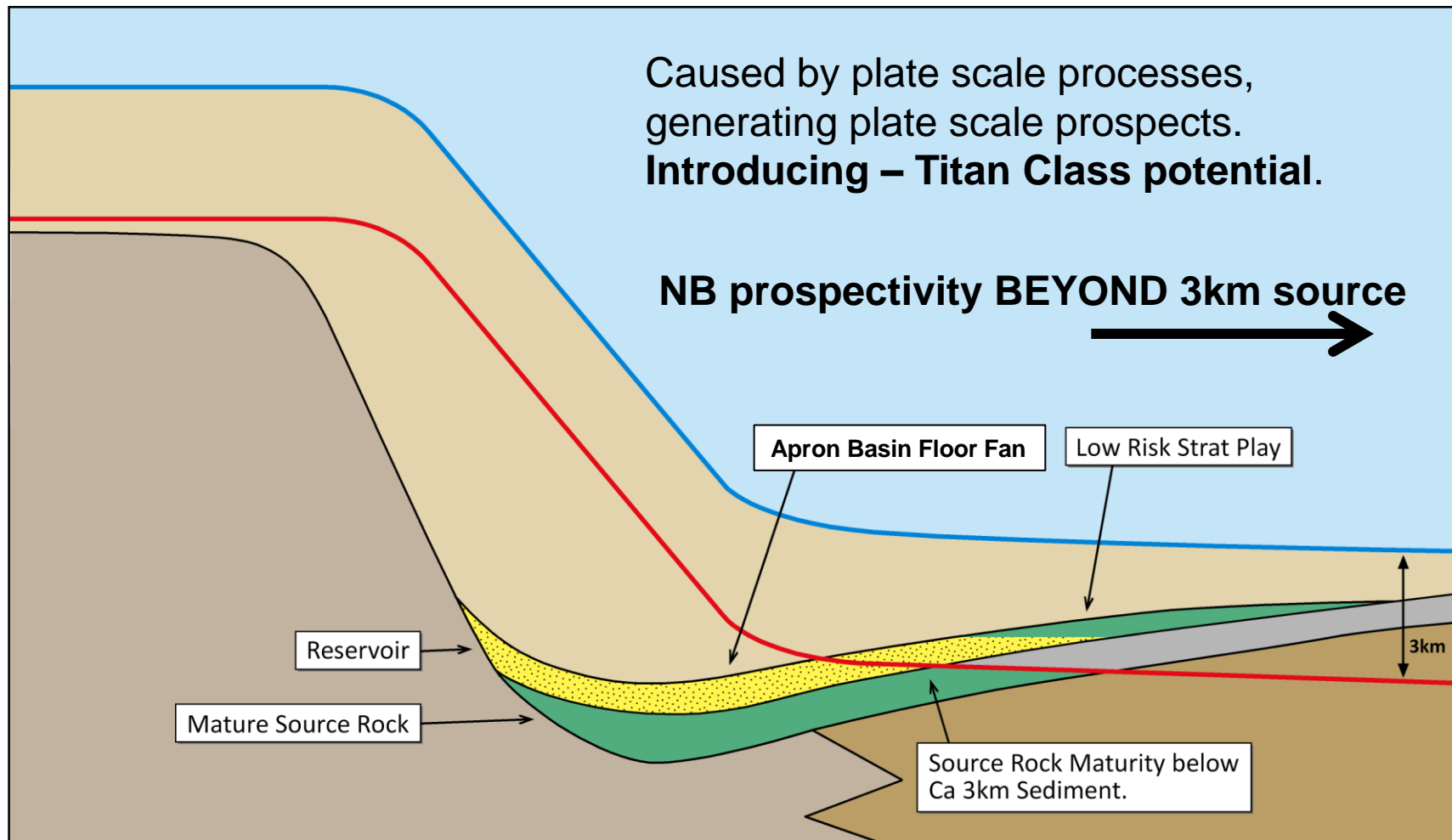
Atlantic half-span East Coast USA



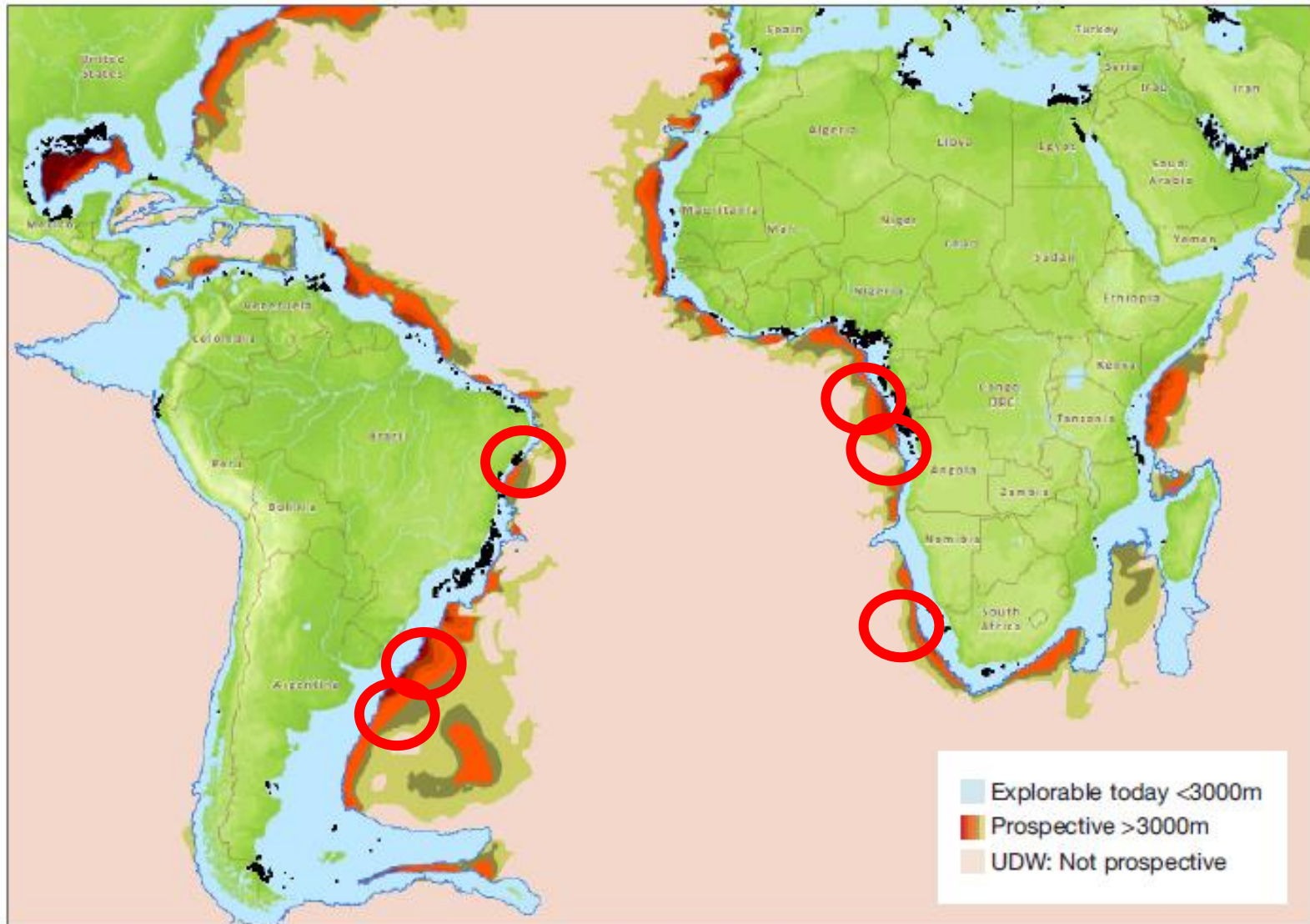
Cooling of Ocean Plate

964km of section

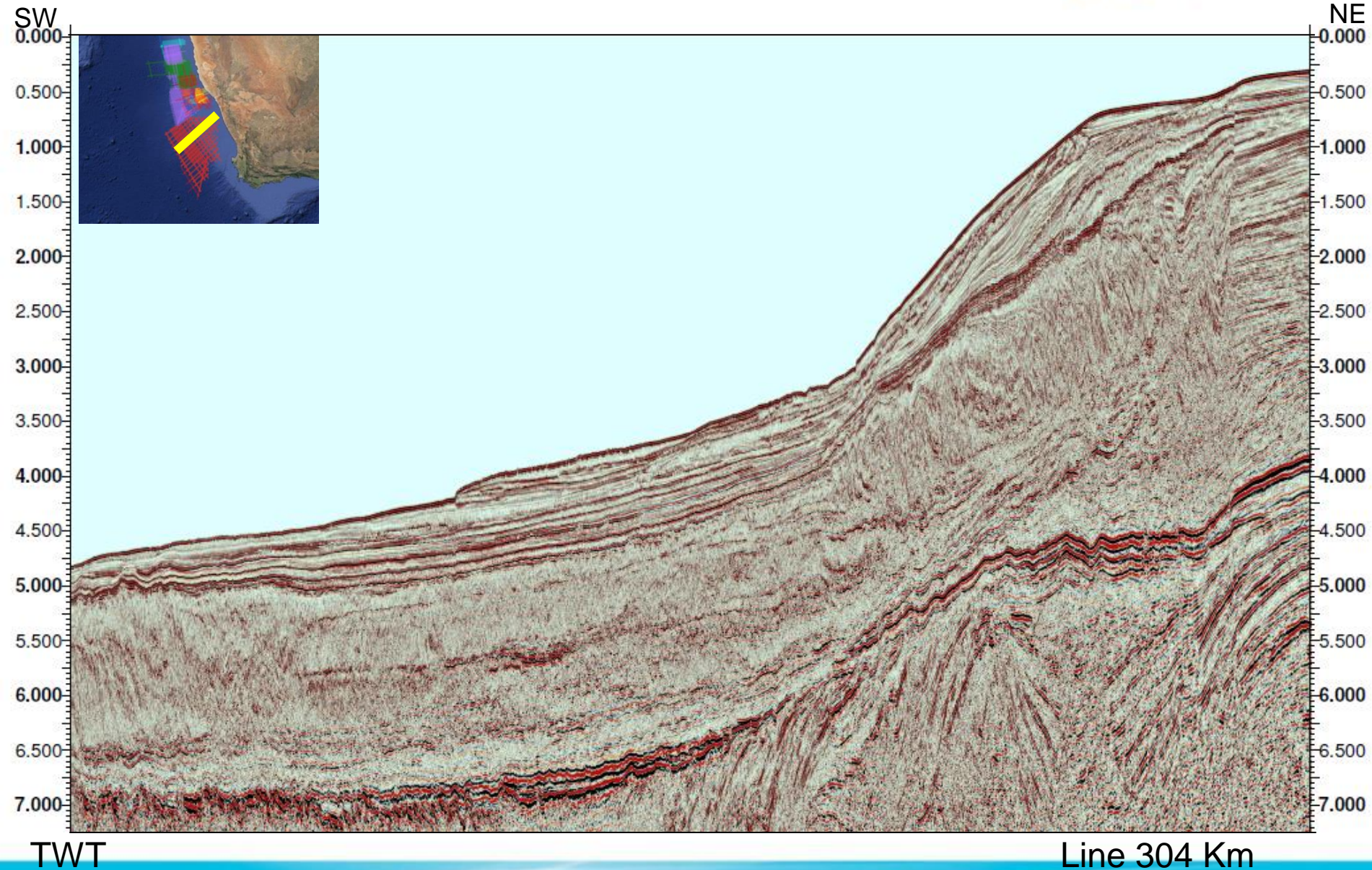
Up-Dip closure of Apron Fan: Low risk stratigraphic play



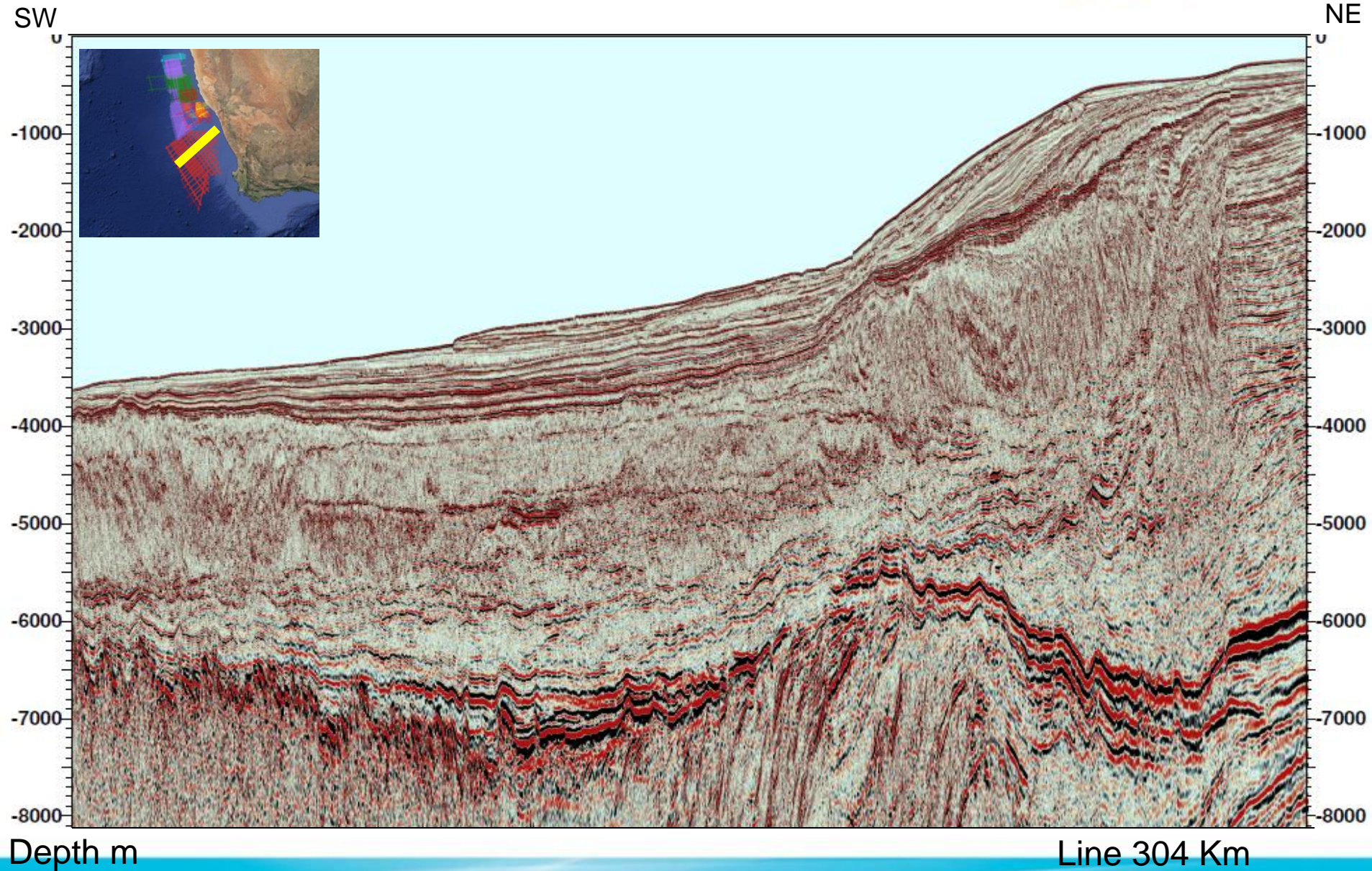
Examples of Prospectivity in UDW



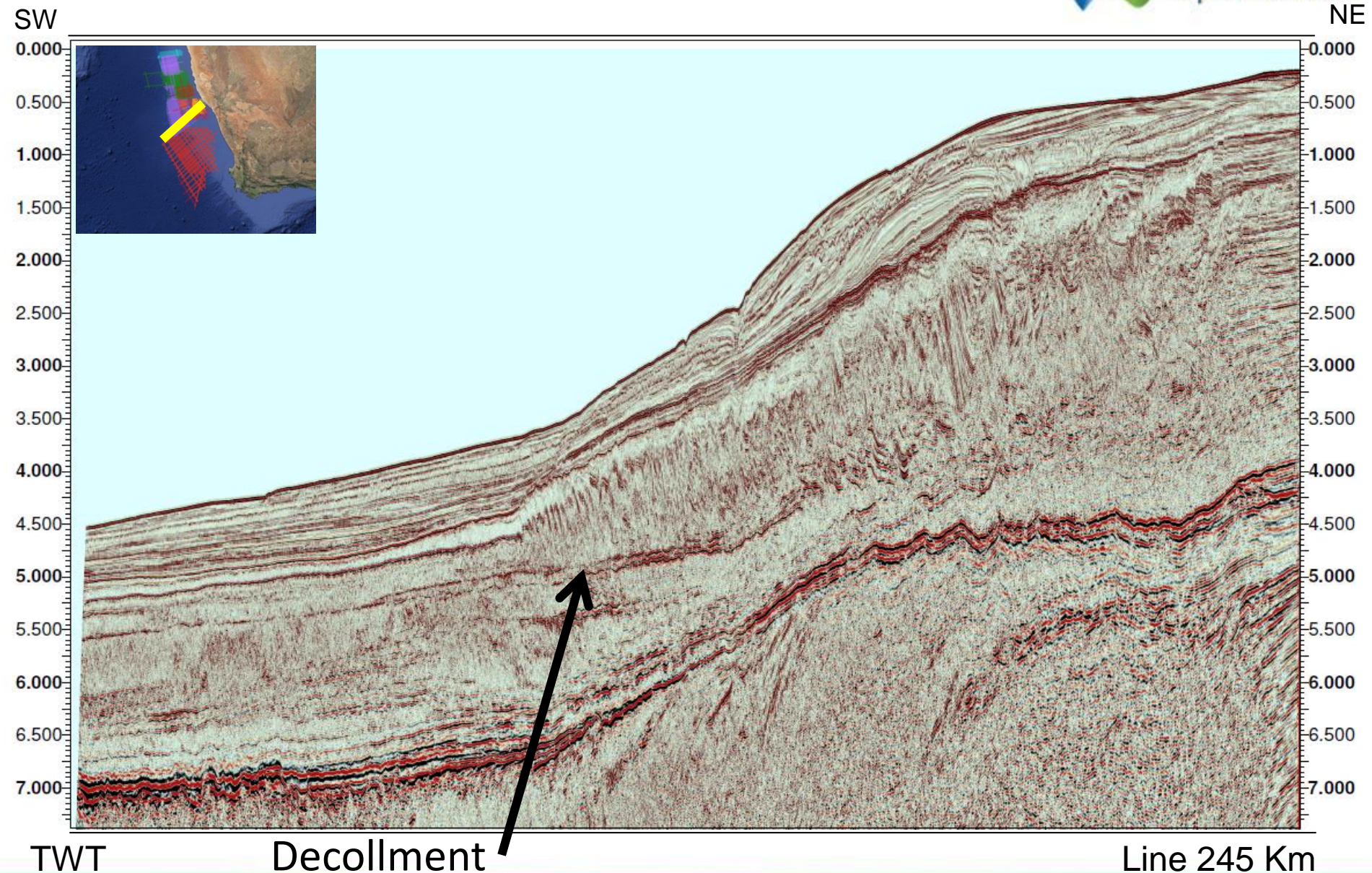
South Africa Orange Basin PSTM



South Africa Orange Basin PSDM



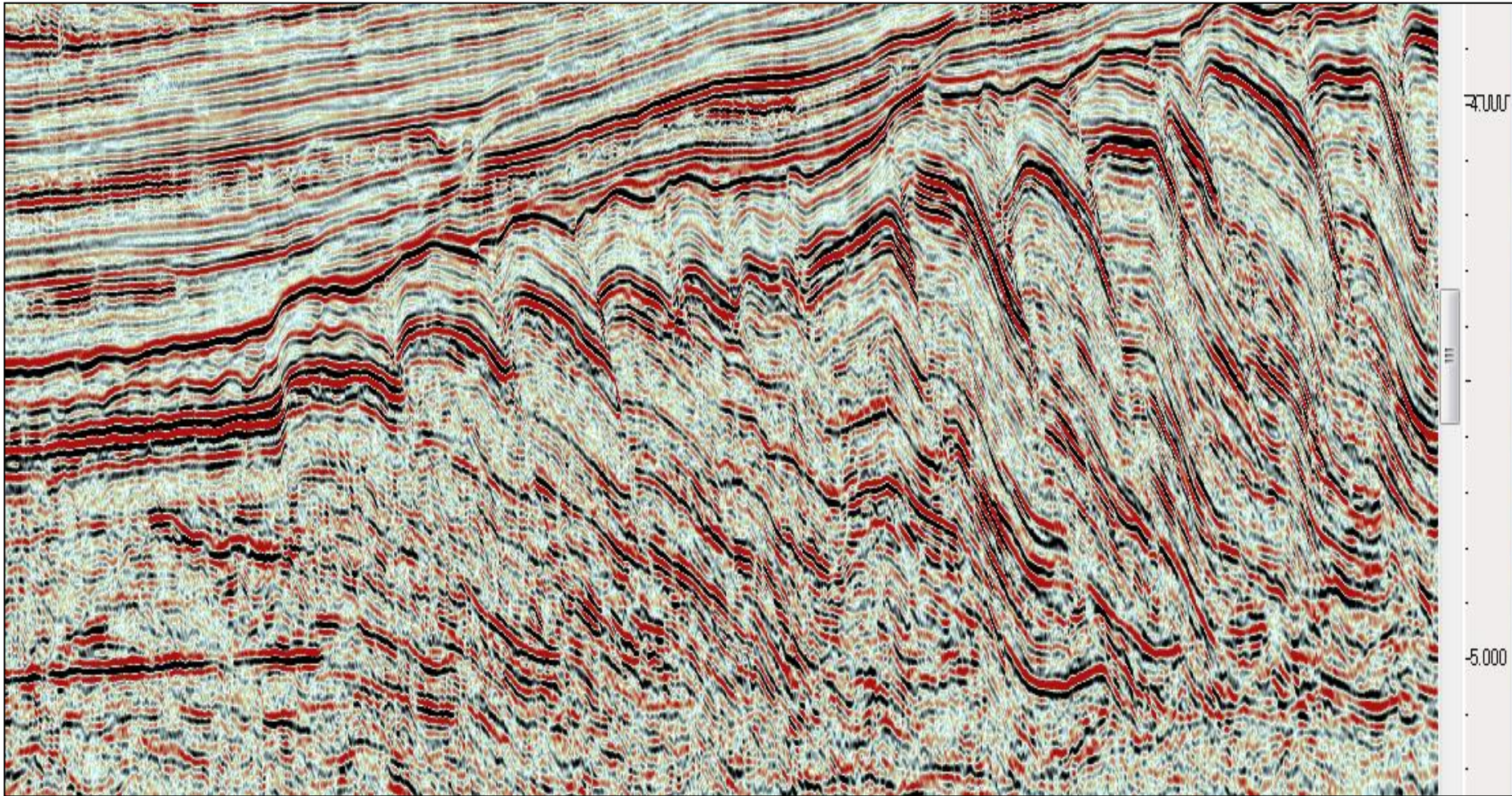
Namibia Orange Basin PSTM



Cretaceous Deltaics: Gravity Plays

W

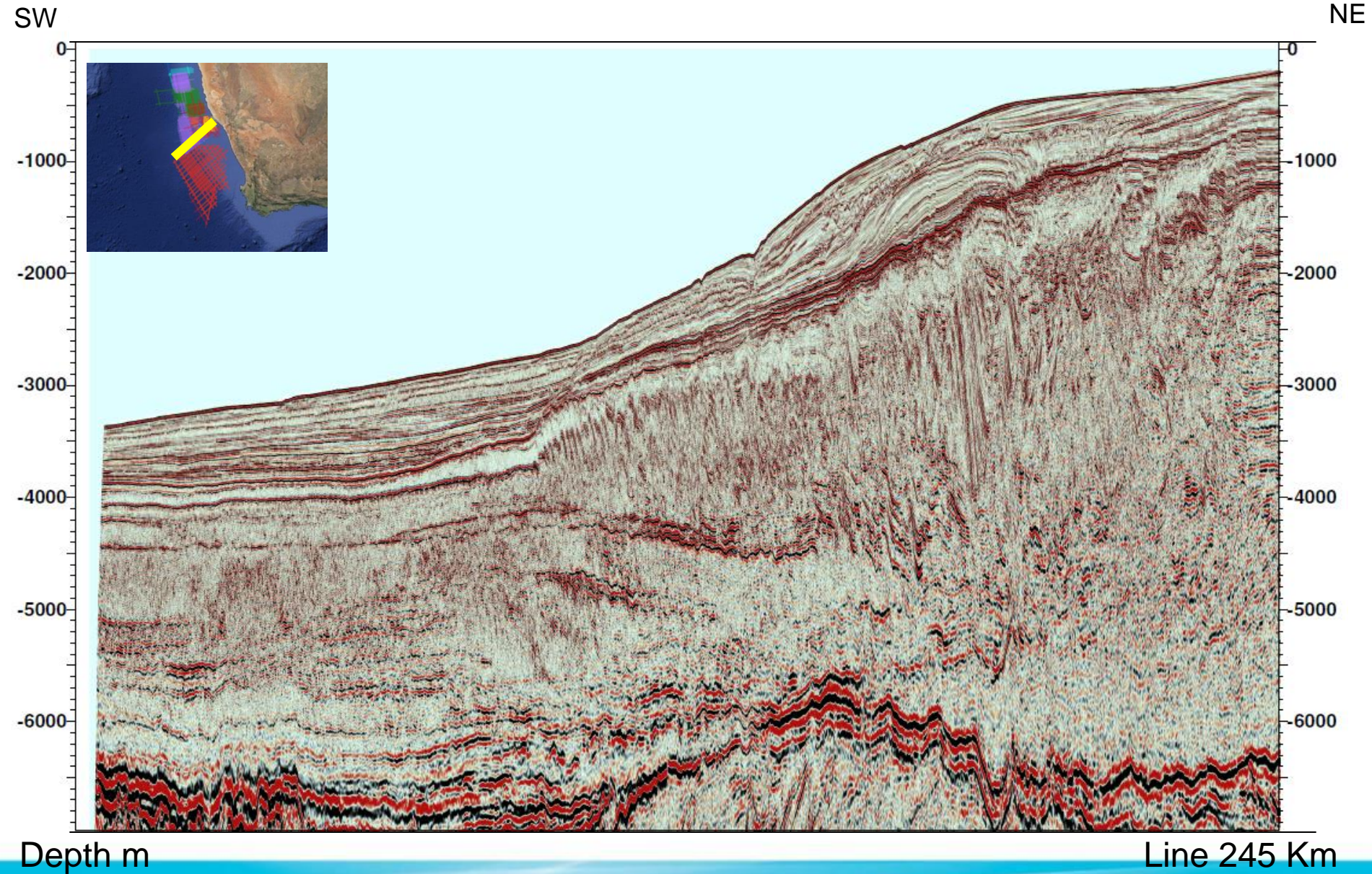
E



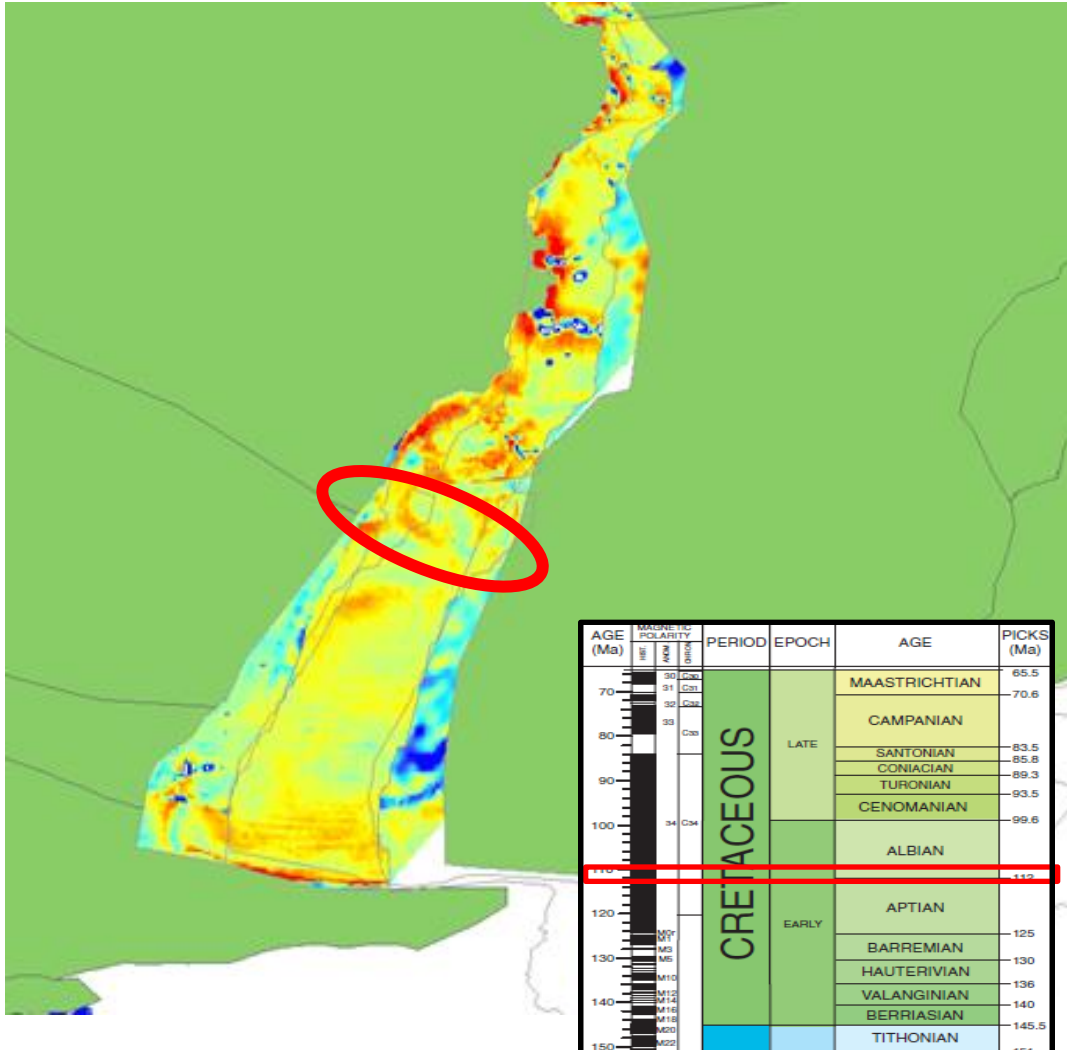
PSTM

Line length 30 km

Namibia Orange Basin PSDM



Early Cretaceous Drift Basin: Ubiquitous Aptian Source Rock

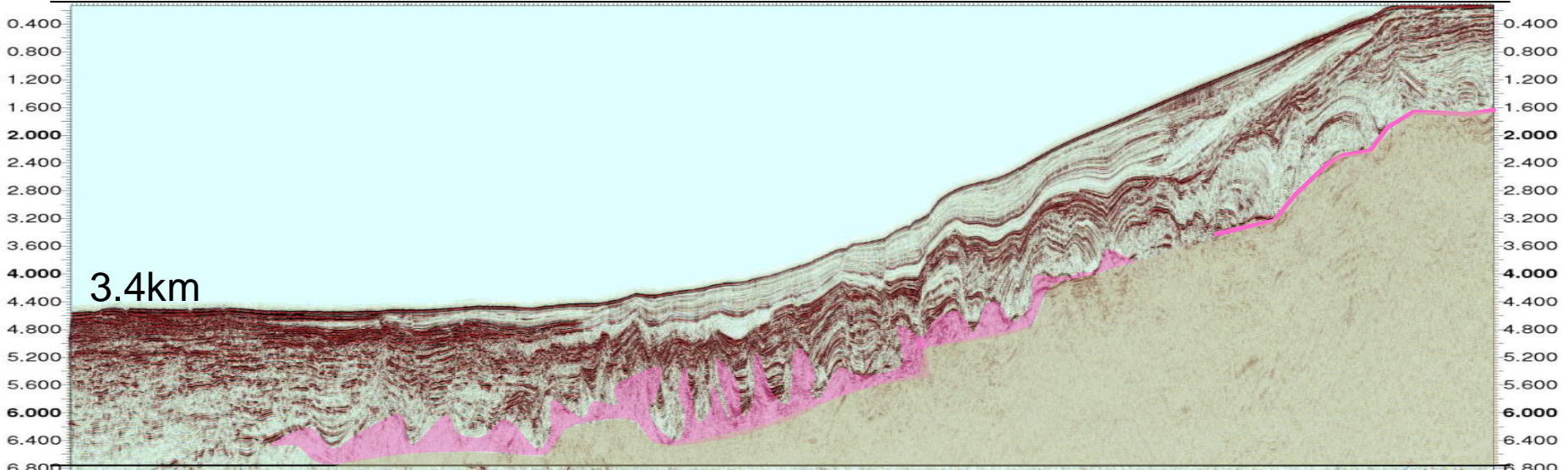


USGS 2006 after Tissot 1980

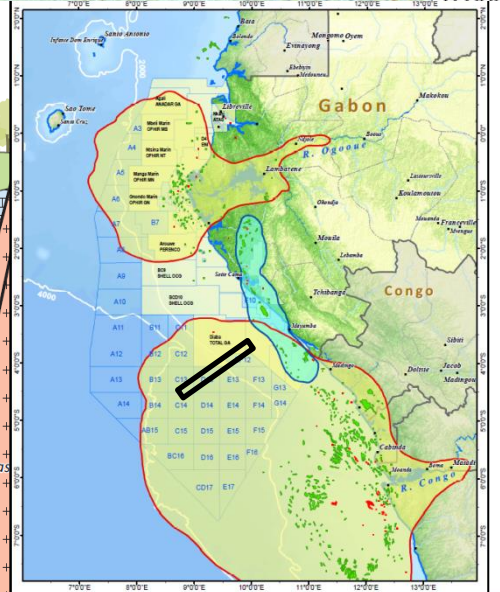
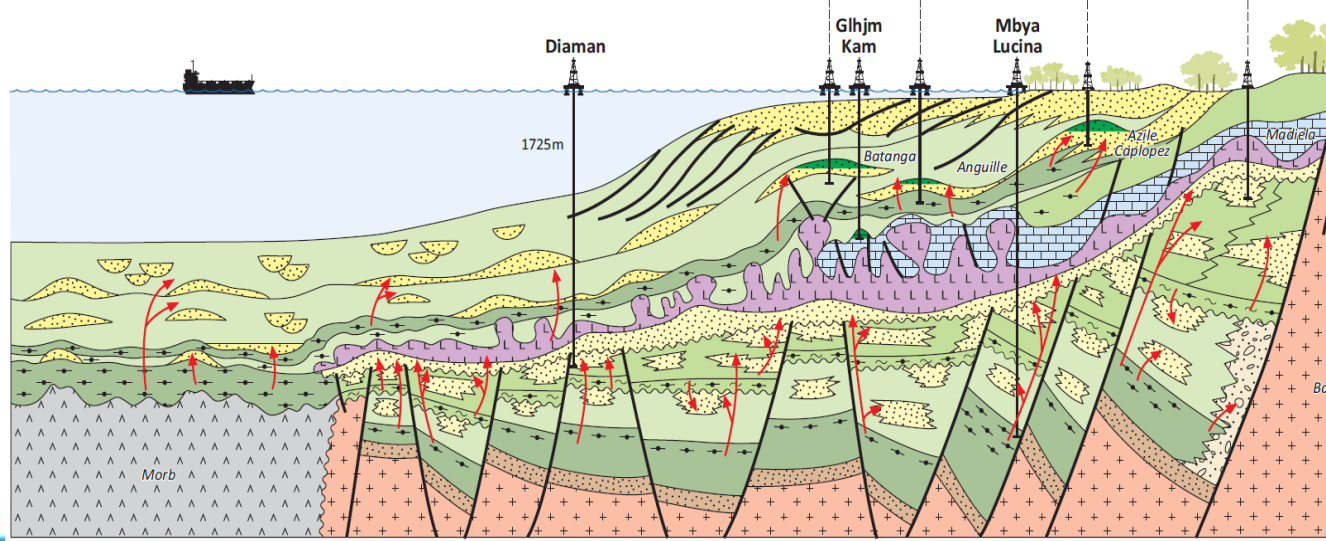
Southern Gabon Post Salt

SW

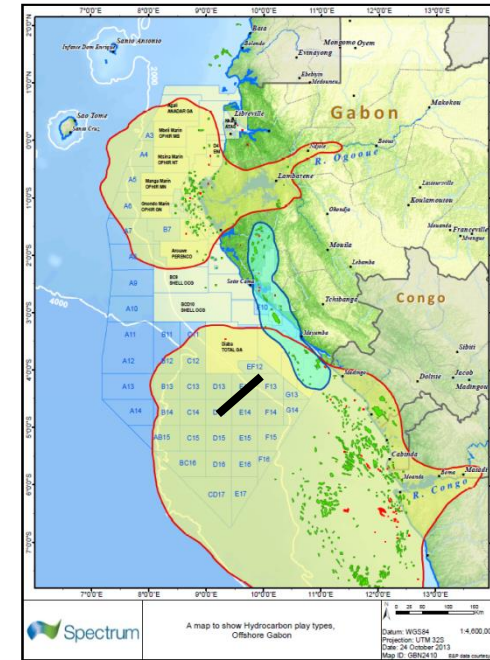
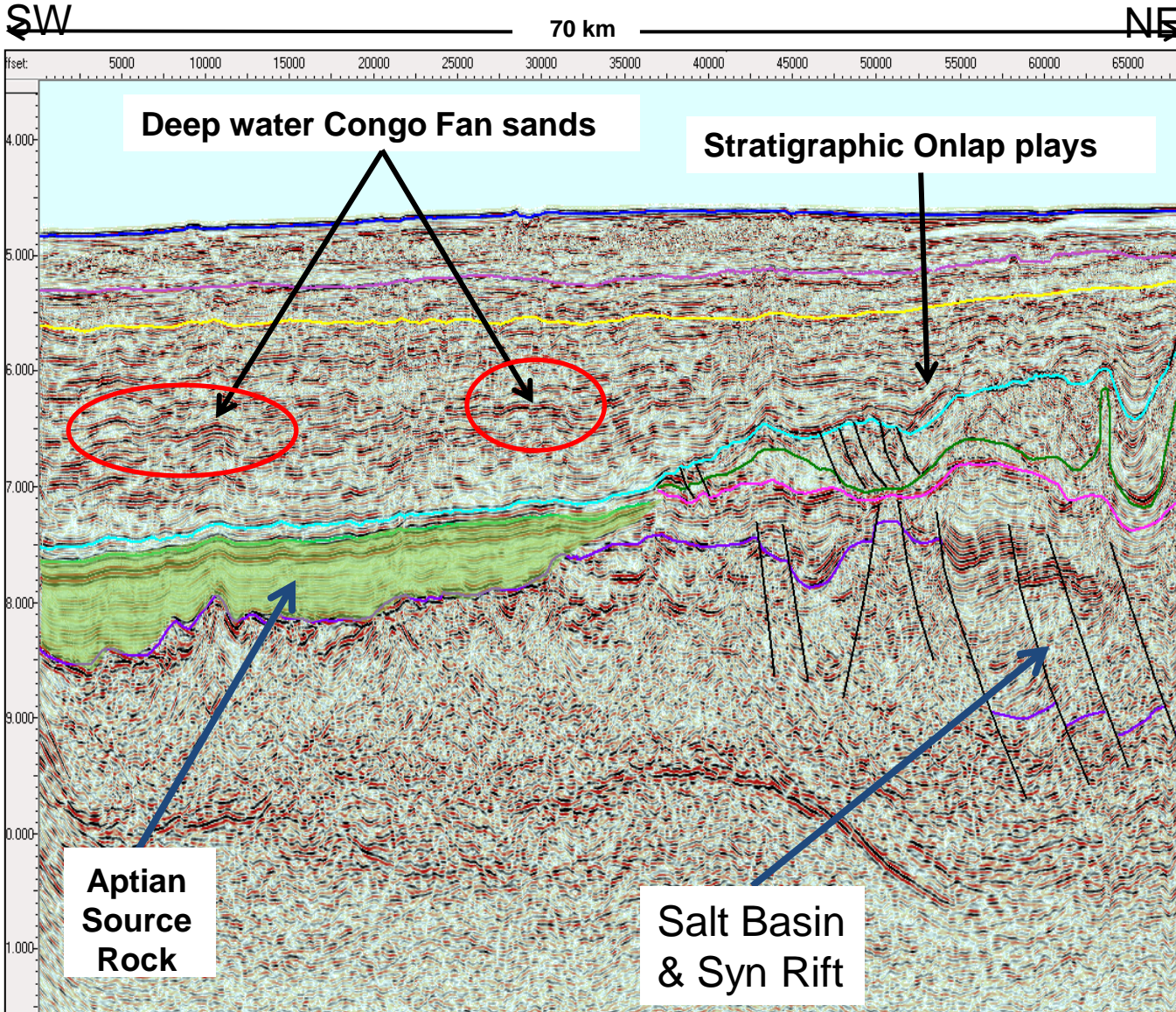
NE



W TWT



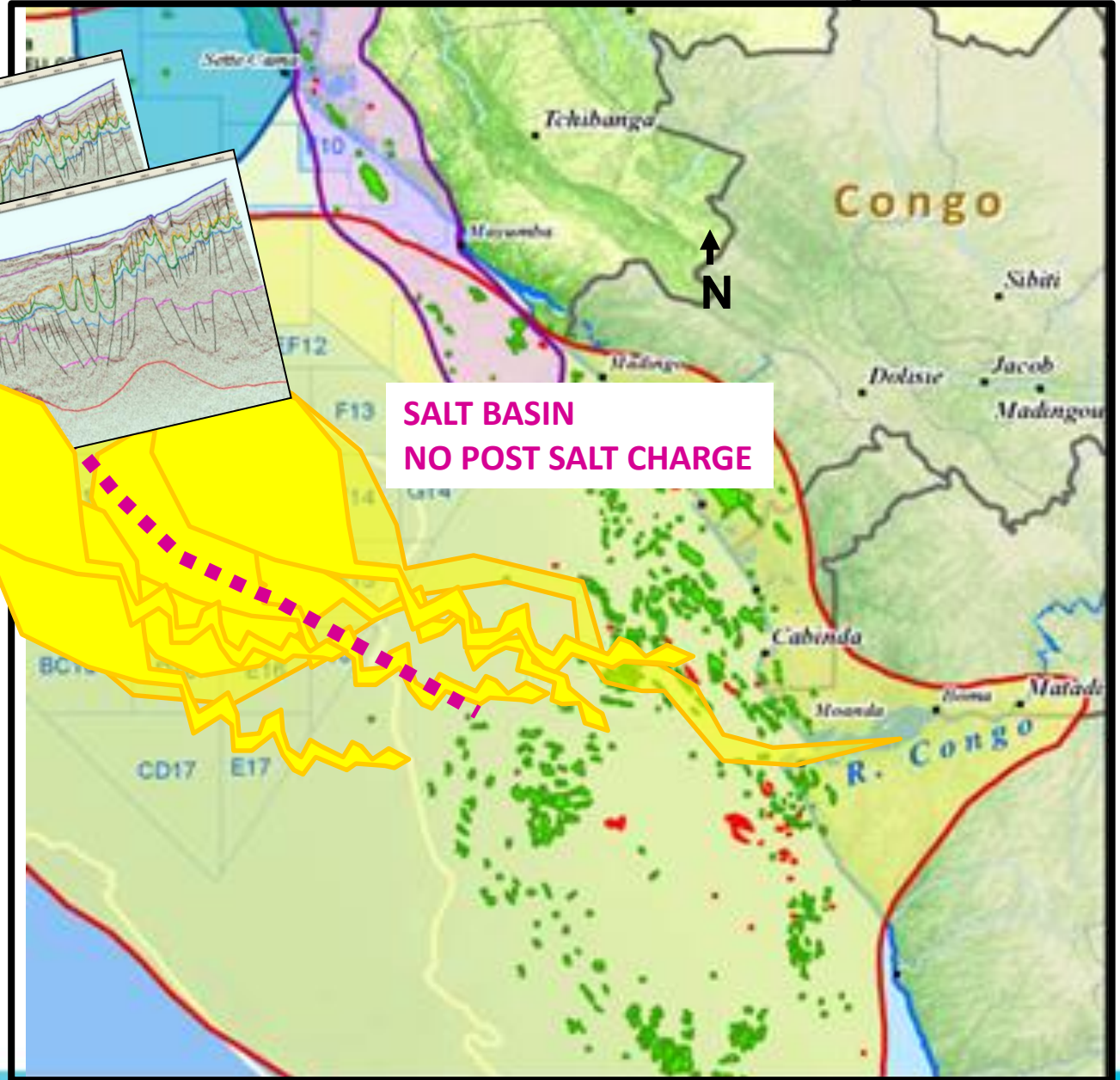
South Gabon – DW & UDW Plays



TWT

Line 70km

Congo Fan Provenance for UDW Basin Floor Play



**SALT BASIN
NO POST SALT CHARGE**

**OUBOARD OF SALT BASIN
MATURE APTIAN CHARGE**

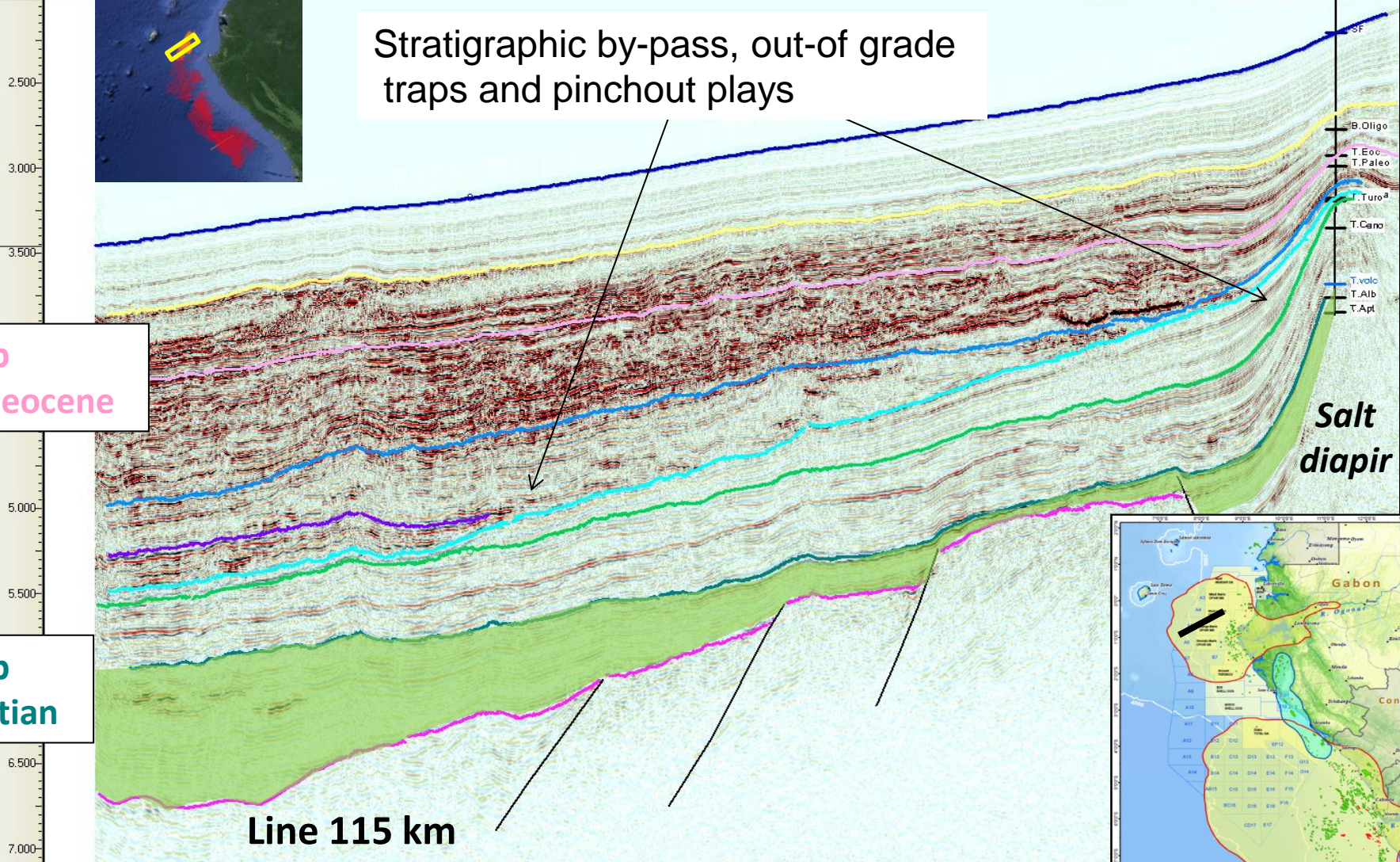
North Gabon Out board of the Salt:

Onlap plays with strong sand supply up-dip: Sergipe analogue



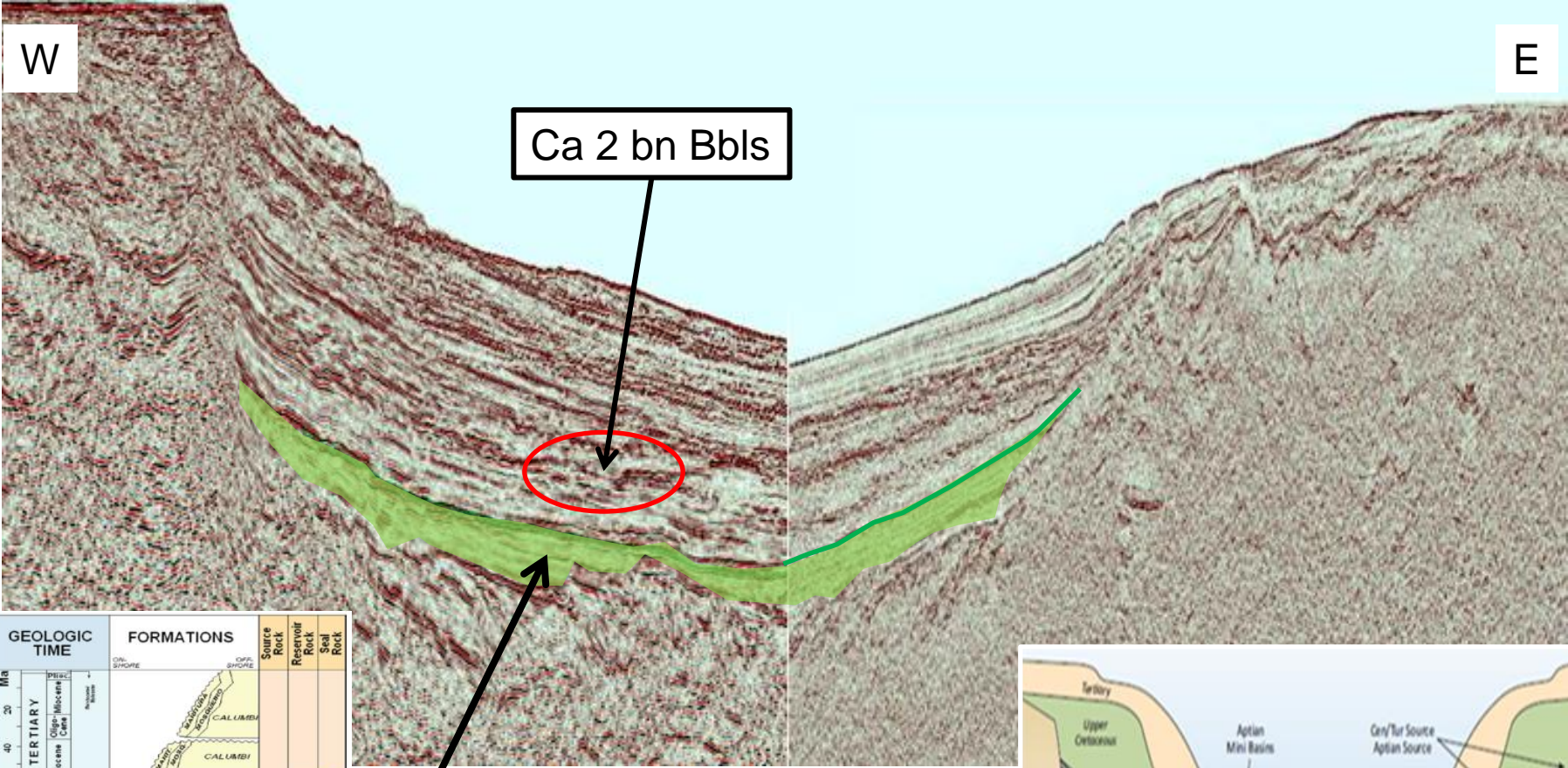
SW

NE



TWT

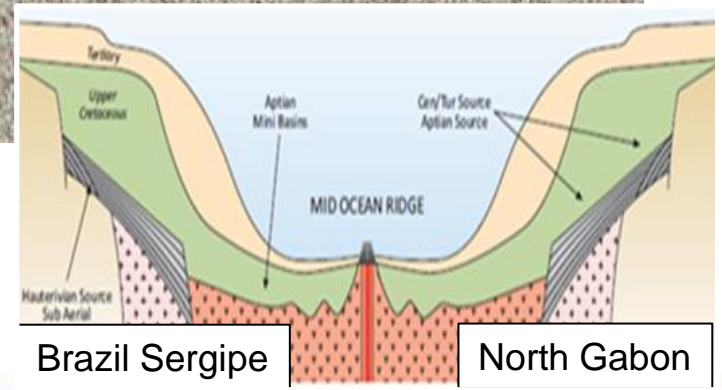
Seismic Reconstruction North Gabon and Sergipe



Ca 2 bn Bbls

GEOLOGIC TIME		FORMATIONS		Source Rock	Reservoir Rock	Seal Rock																																									
TERTIARY	Ma	Oligo-Miocene Cenozoic	CALUMBI	Oil Shale	Oil Shale	Oil Shale																																									
							Eocene	CALUMBI	Oil Shale	Oil Shale	Oil Shale																																				
												Senonian (Pal.)	CALUMBI	Oil Shale	Oil Shale	Oil Shale																															
																	Maastr.	CALUMBI	Oil Shale	Oil Shale	Oil Shale																										
																						Campan.	CALUMBI	Oil Shale	Oil Shale	Oil Shale																					
																											Cenozoic	COTINGUIBA	Oil Shale	Oil Shale	Oil Shale																
																																Albian	RIACHELO	Oil Shale	Oil Shale	Oil Shale											
																																					Cretaceous	Aptian	MUDA RIELO / MACEO	Oil Shale	Oil Shale	Oil Shale					
																																											Barremian	COQUEIRO SECO	Oil Shale	Oil Shale	Oil Shale
Valang.	BARRA DE ITIUBA	Oil Shale	Oil Shale	Oil Shale																																											
					Berrias.	BARRA DE ITIUBA	Oil Shale	Oil Shale	Oil Shale																																						
										JUR.	SERRARIA / BARANERAS	Oil Shale	Oil Shale	Oil Shale																																	

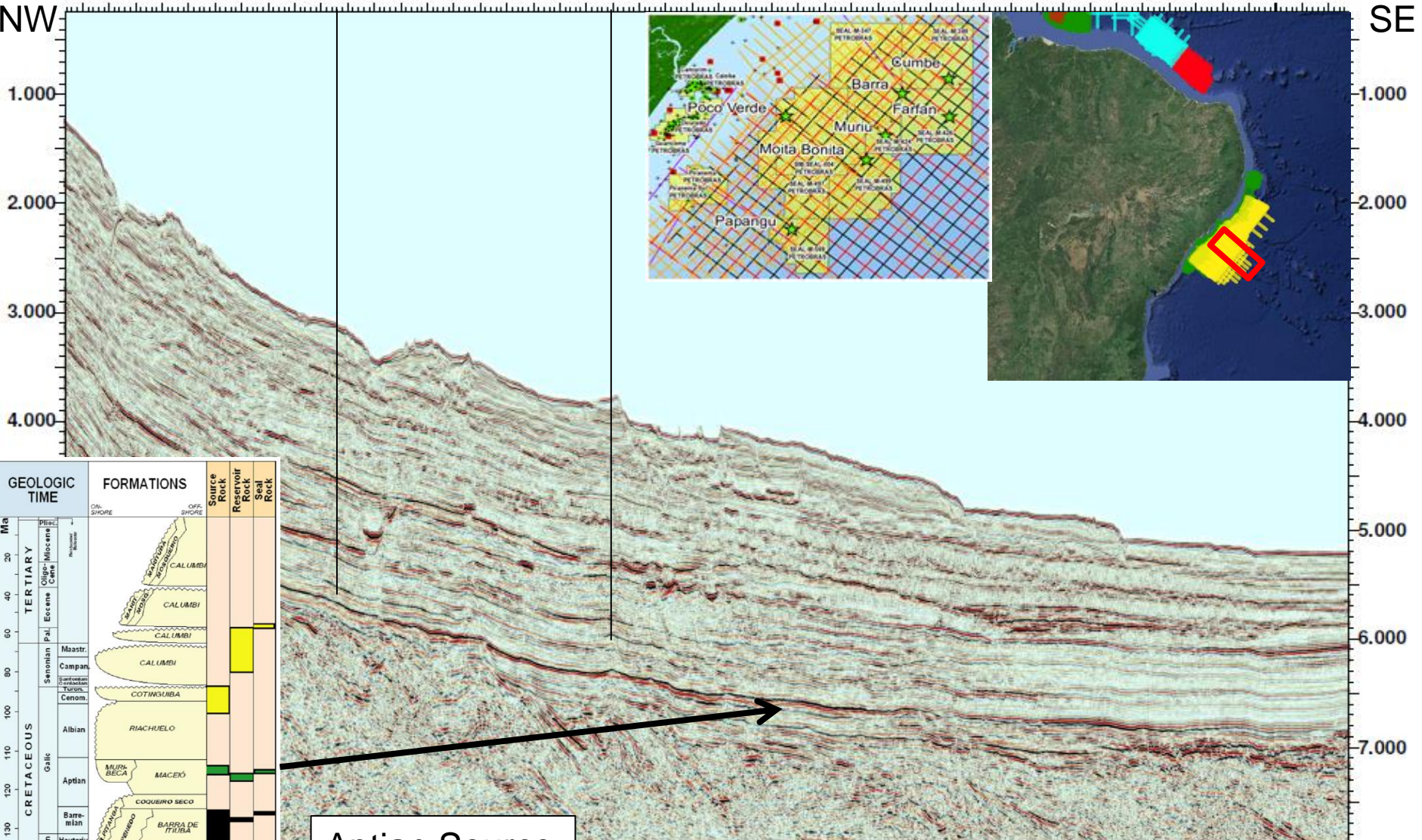
Aptian Source
3-5% TOC



Brazil Sergipe

North Gabon

Sergipe example 2 PSTM

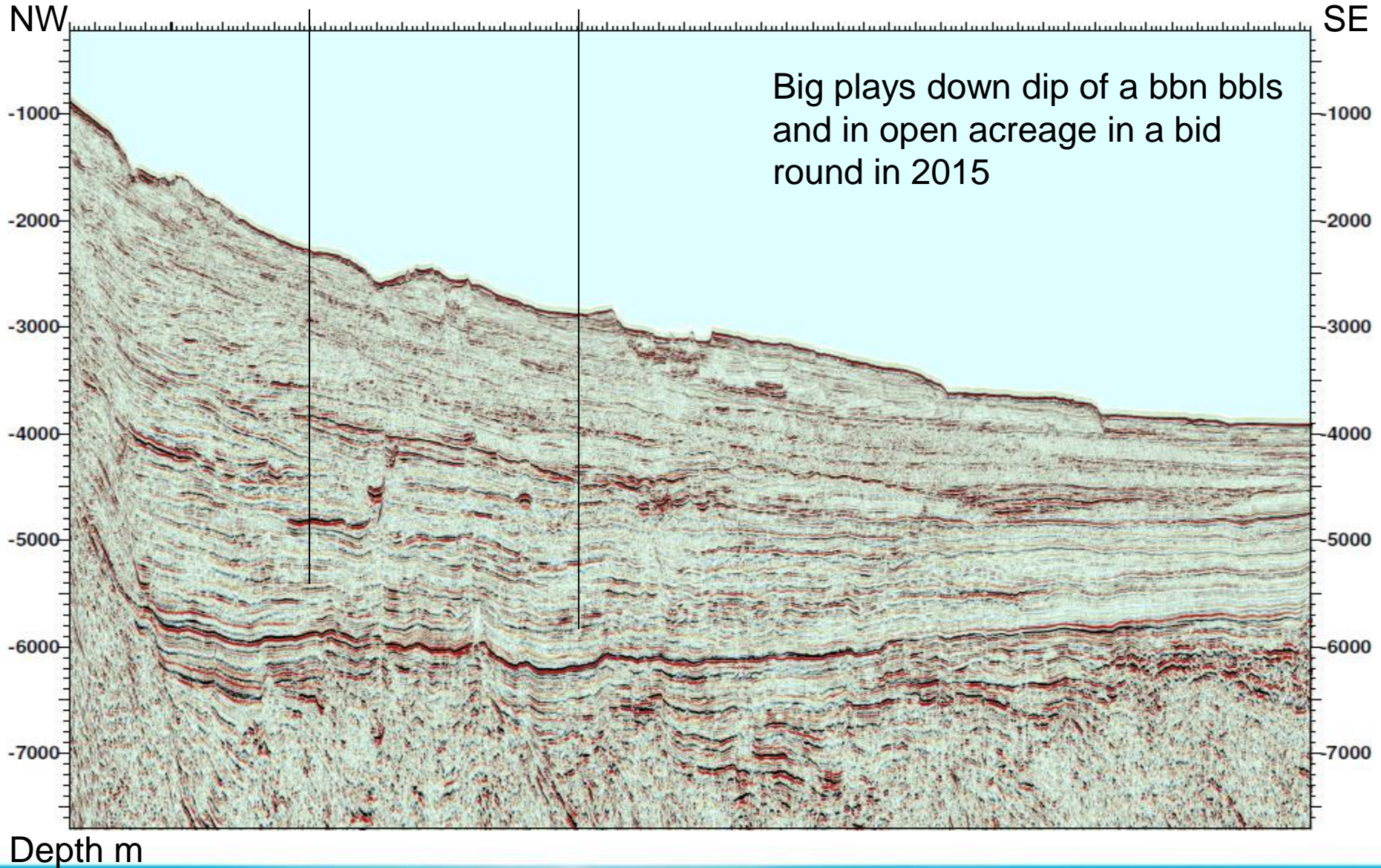


GEOLOGIC TIME		FORMATIONS		Source Rock	Reservoir Rock	Seal Rock
Ma	Period	Formation	Off-shore			
0 - 20	TERTIARY	Calumbi	Off-shore			
20 - 40		Calumbi	Off-shore			
40 - 60		Calumbi	Off-shore			
60 - 80	Cenozoic	Calumbi	Off-shore			
80 - 100		Cotinguba	Off-shore			
100 - 110	CRETACEOUS	Riachuelo	Off-shore			
110 - 120		Mujica Seca / Maceio	Off-shore			
120 - 130	Cretaceous	Coqueiro Seco	Off-shore			
130 - 140		Barra de Itiuba	Off-shore			
140 - 150	JURASSIC	Barra de Itiuba	Off-shore			
150 - 160		Serraria / Bananeiras	Off-shore			

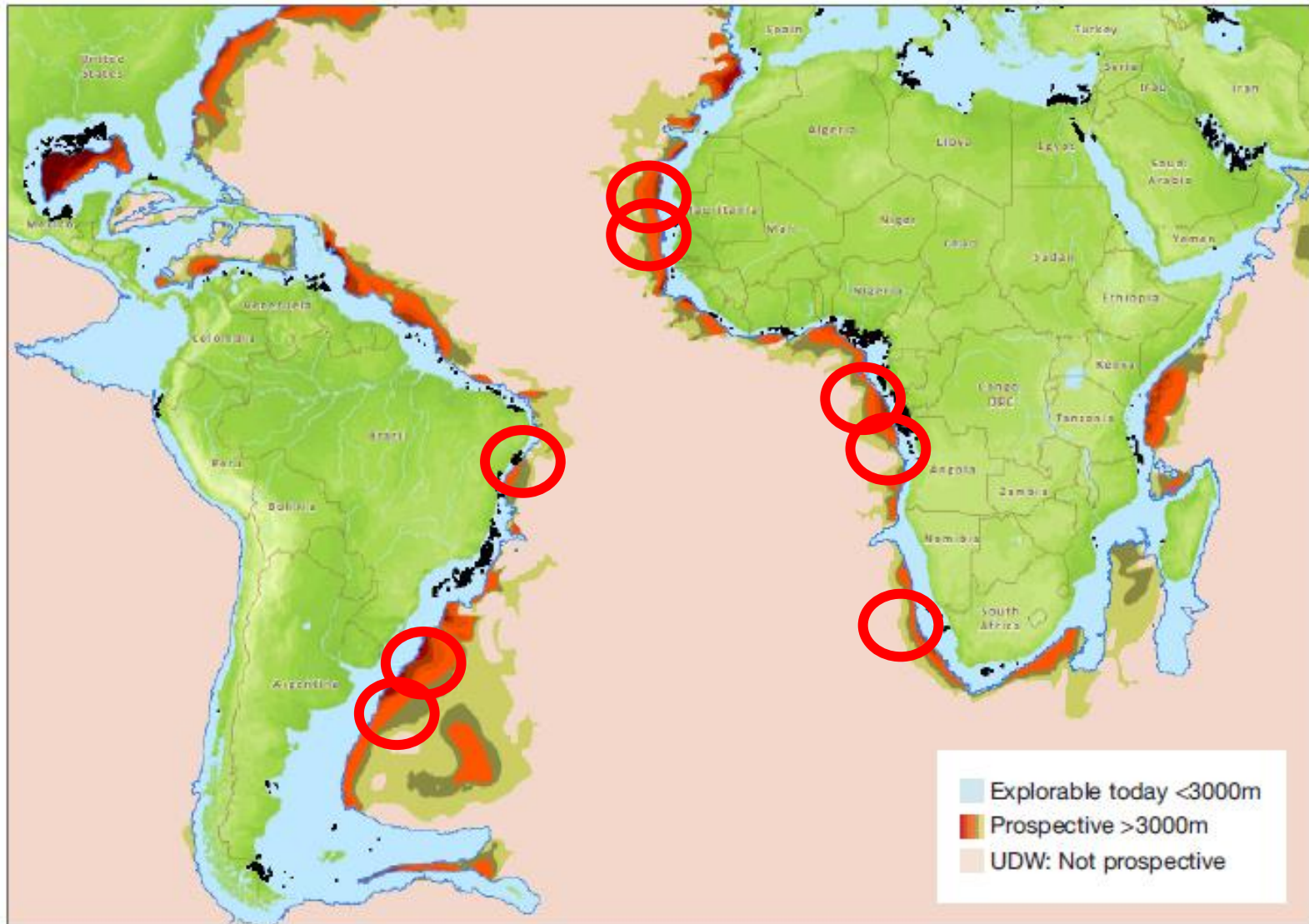
Aptian Source
3-5% TOC

Line 118km
TWT

Sergipe example 2 PSDM



“Prospective” Areas in UDW

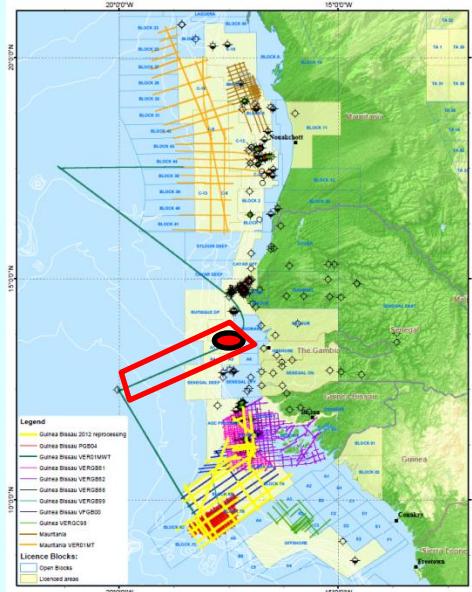
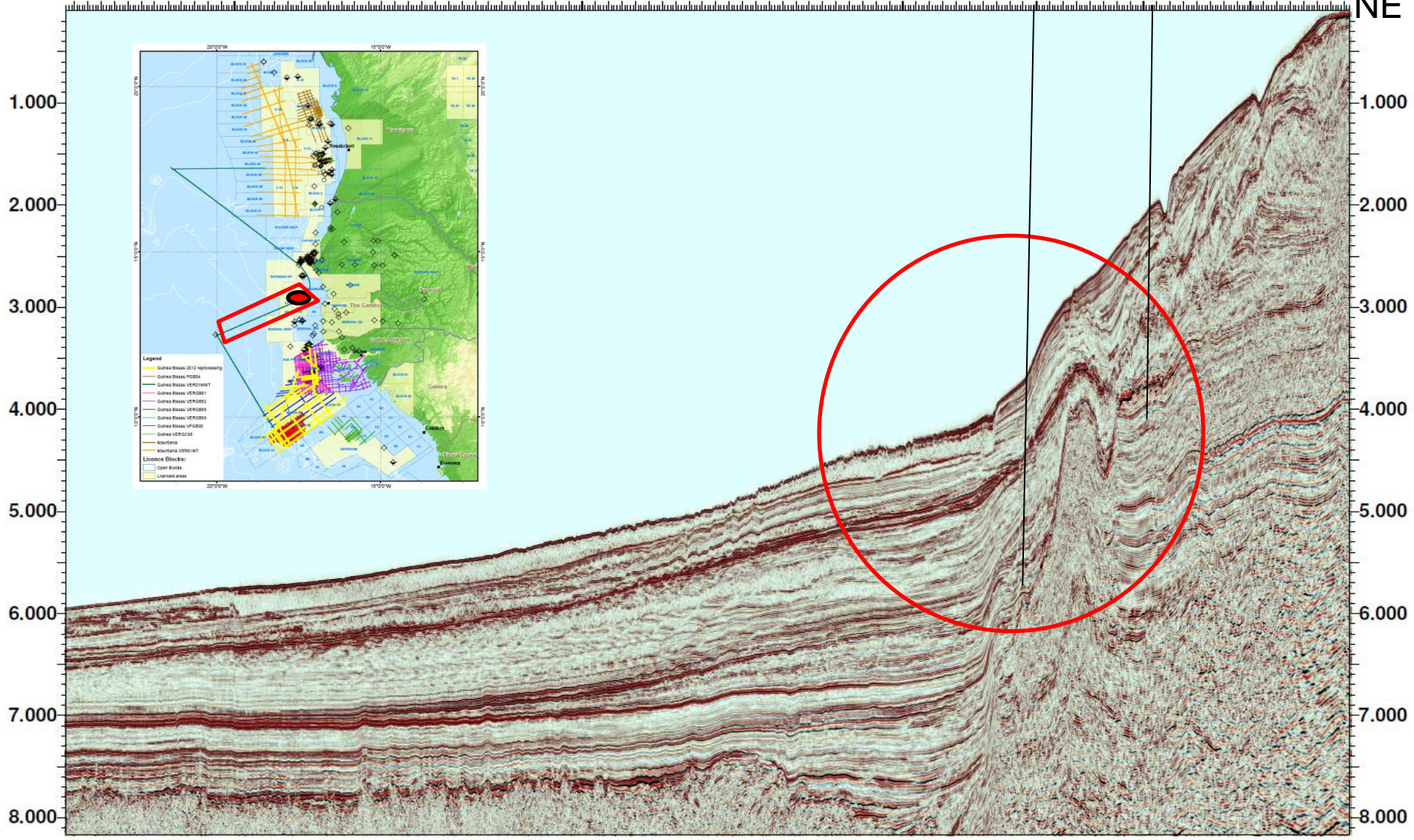


Deepwater Senegal PSTM

SW



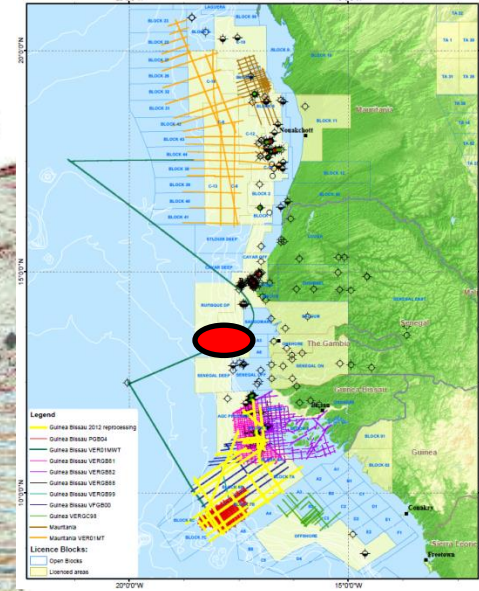
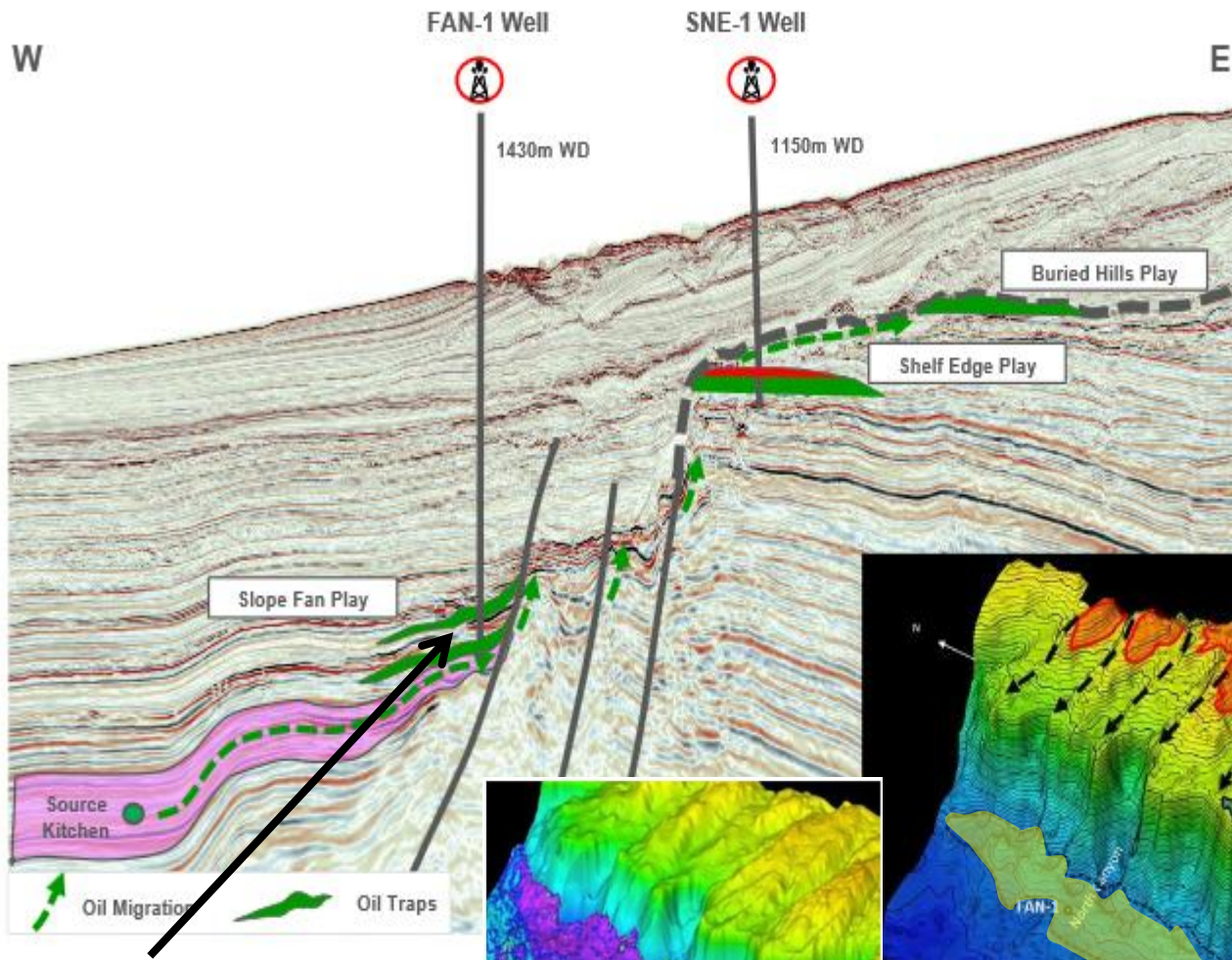
NE



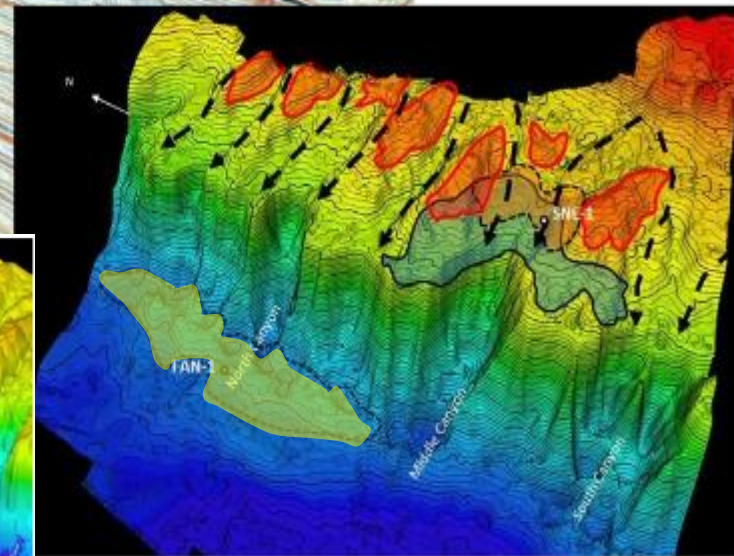
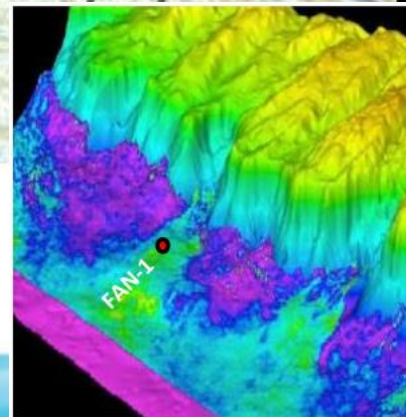
TWT

Line 205 km

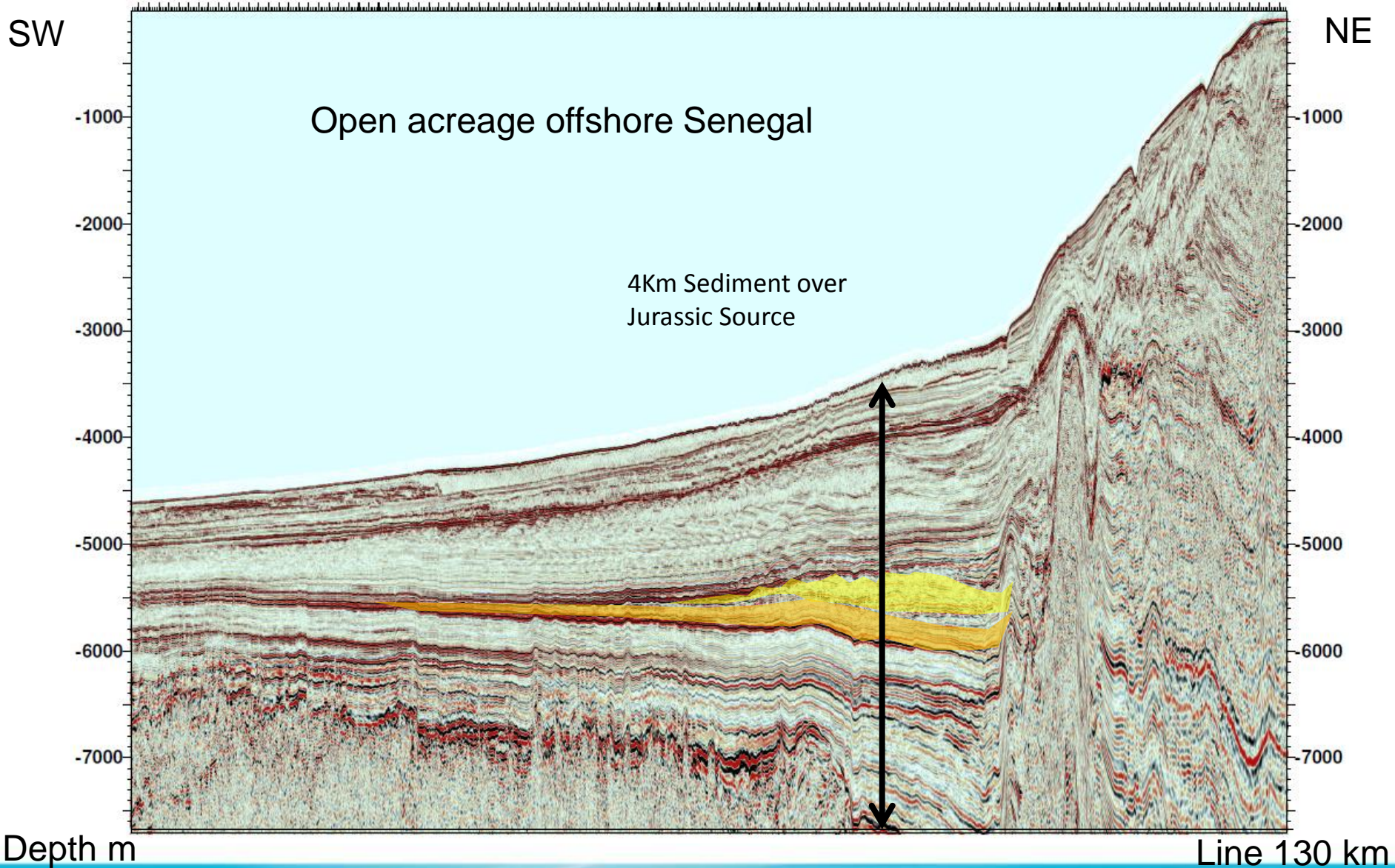
Senegal: Cairn Discoveries



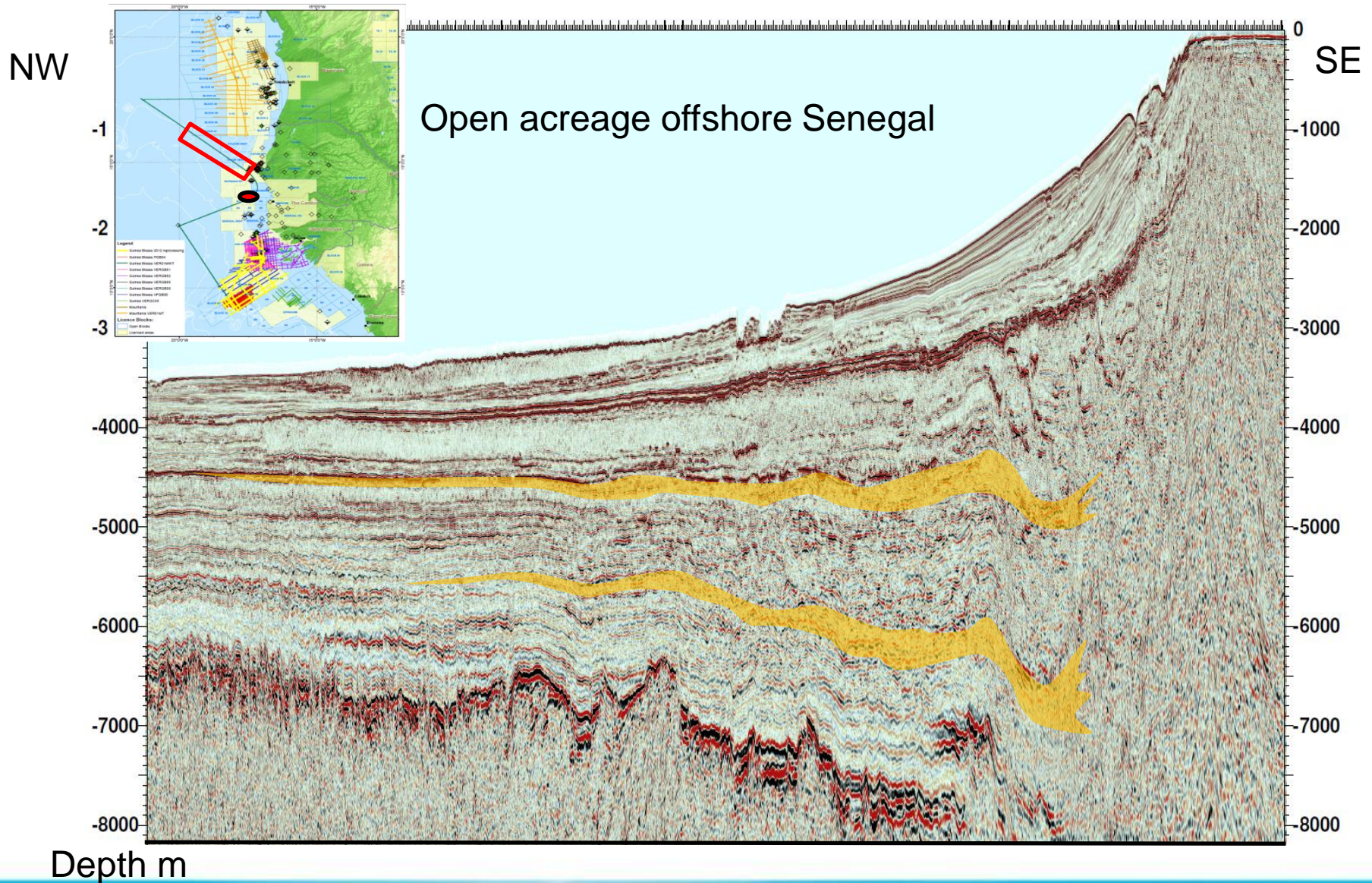
Campanian and Santonian Fans



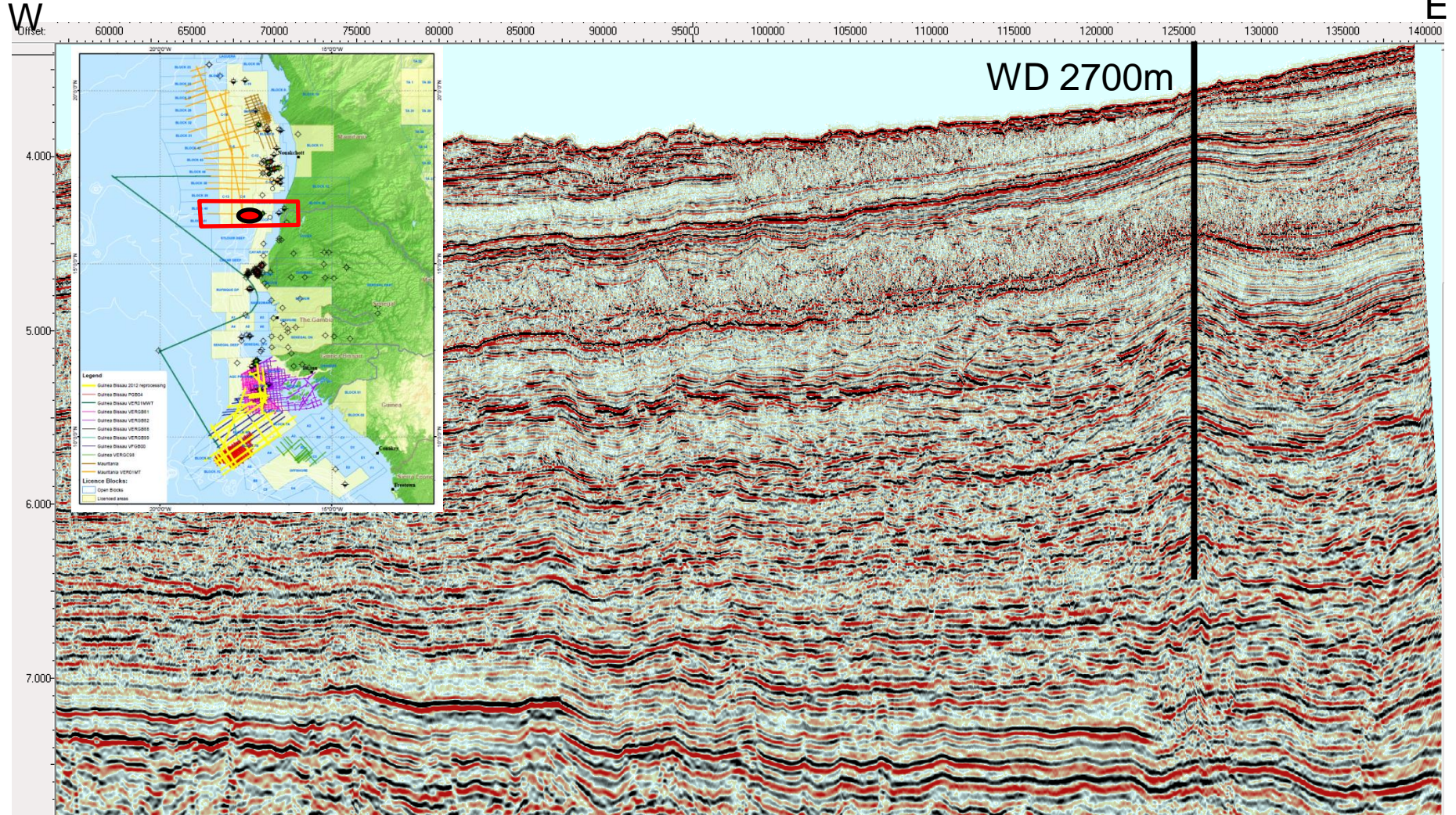
Deepwater Senegal up-dip apron fan play



Senegal north depth



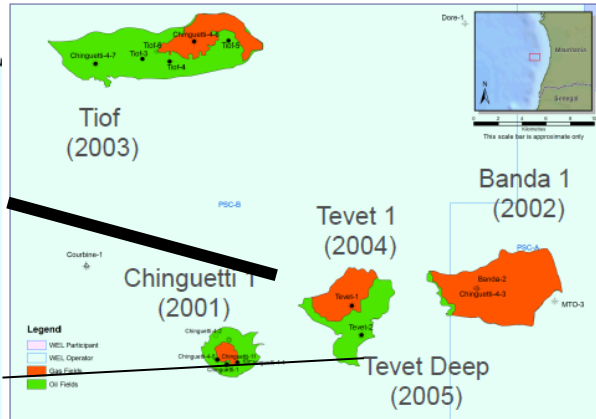
Deepwater Mauritania: Kosmos Tortue Well PSTM



90sqkm: gas in Cenomanian Apron Fan

Line 184 km

Mauritania PSTM TWT section



W

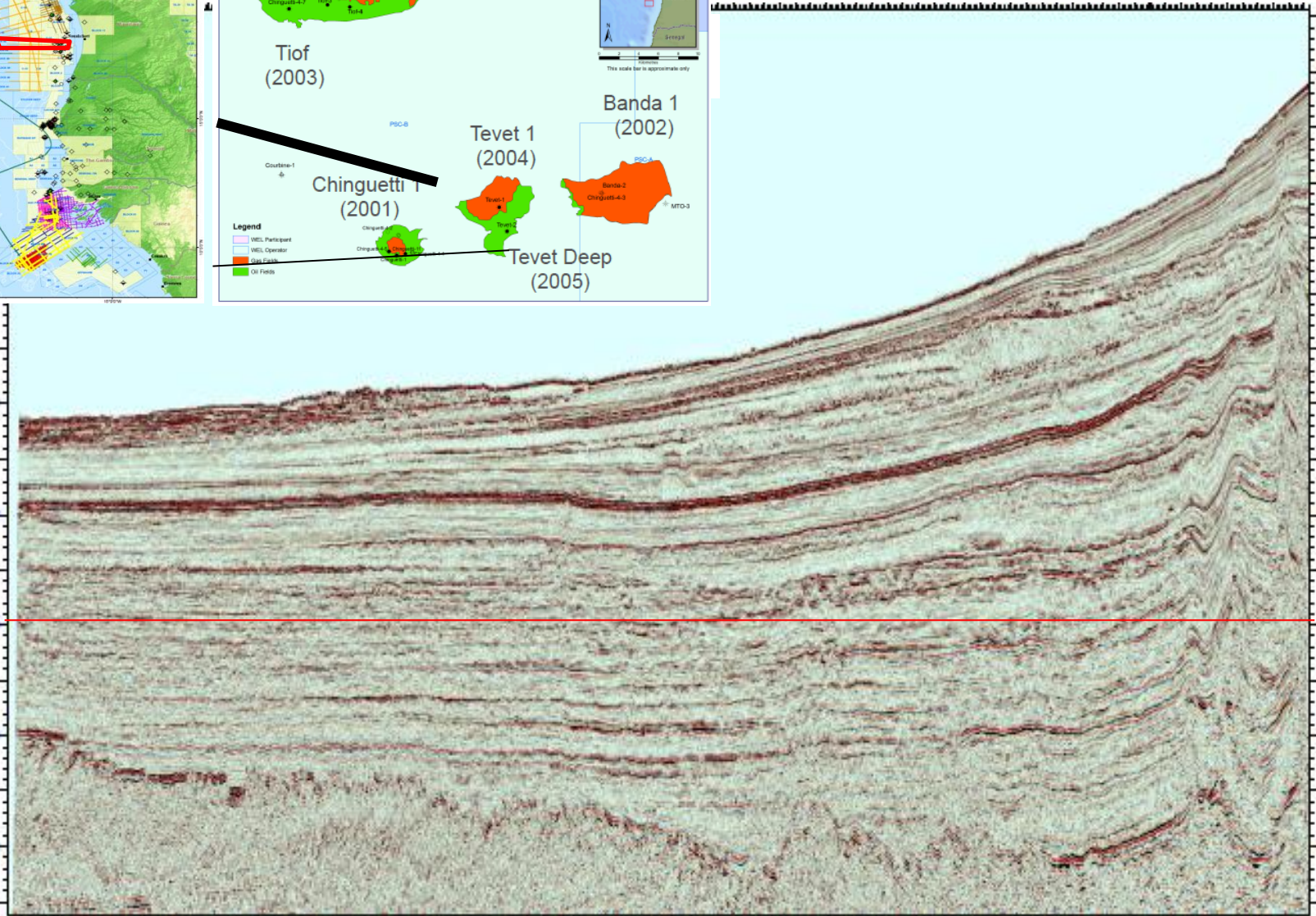
4.000
5.000
6.000
7.000
8.000

E

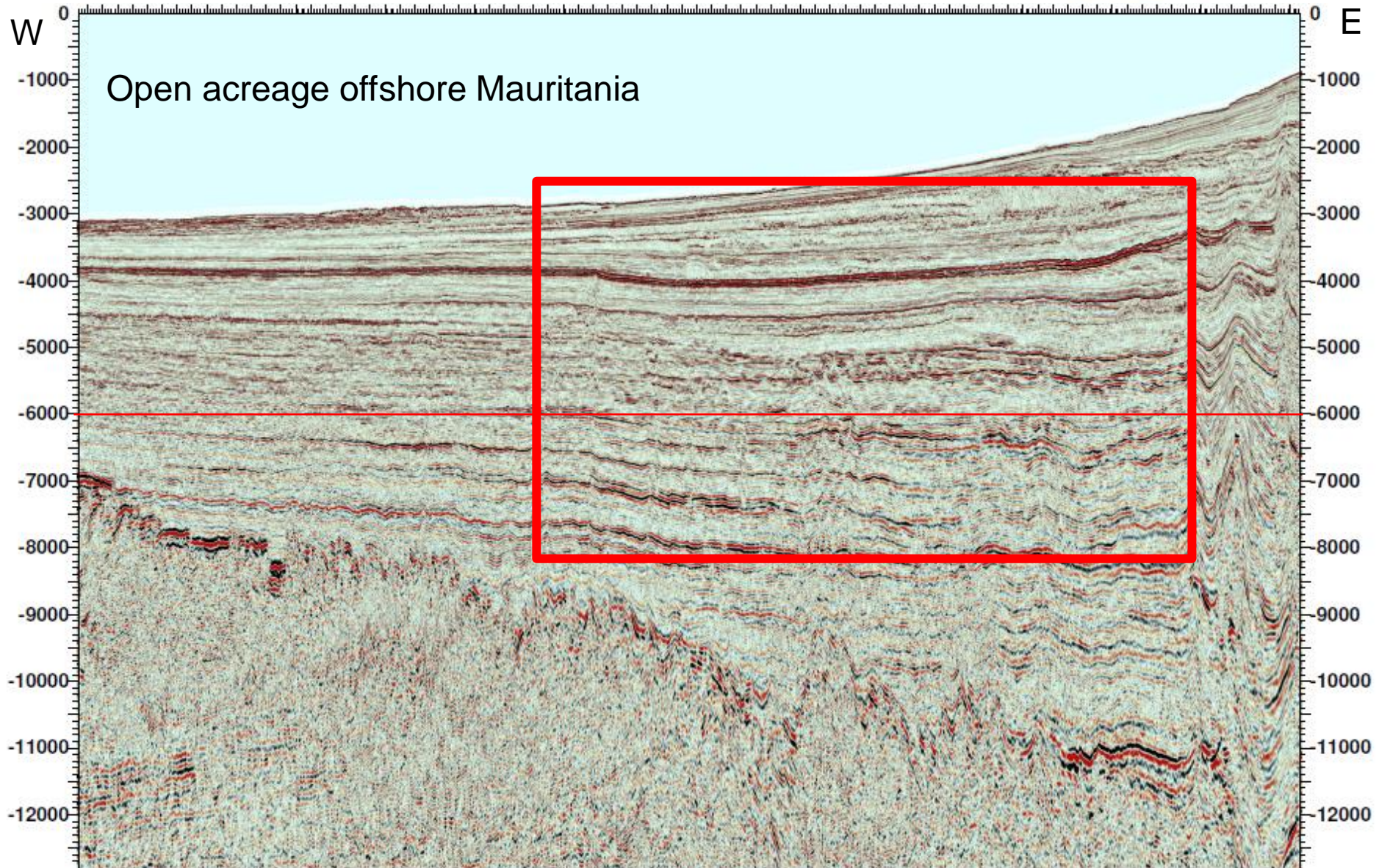
1.000
2.000
3.000
4.000
5.000
6.000
7.000
8.000

TWT

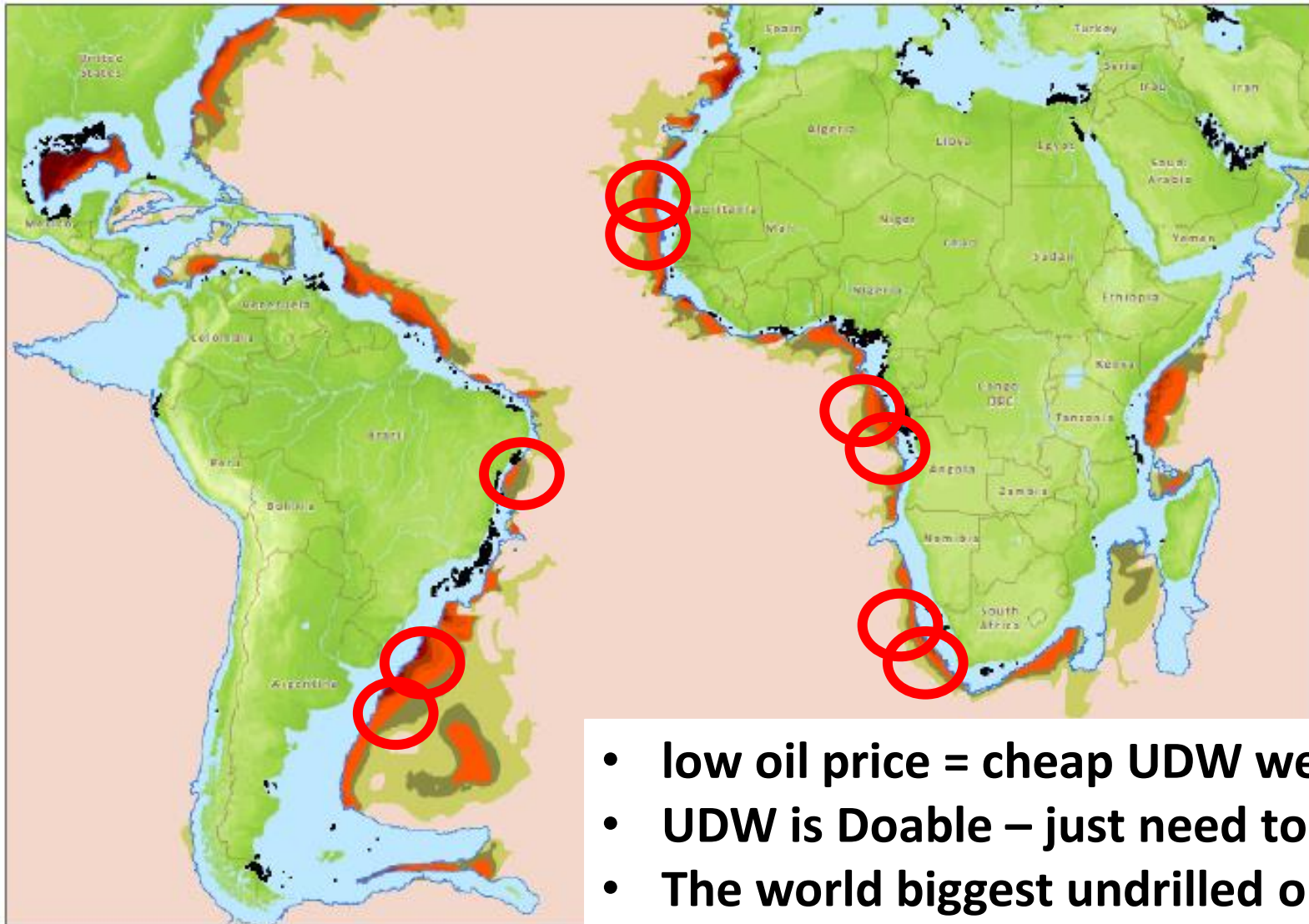
Line 205 km



Mauritania Depth Converted Line

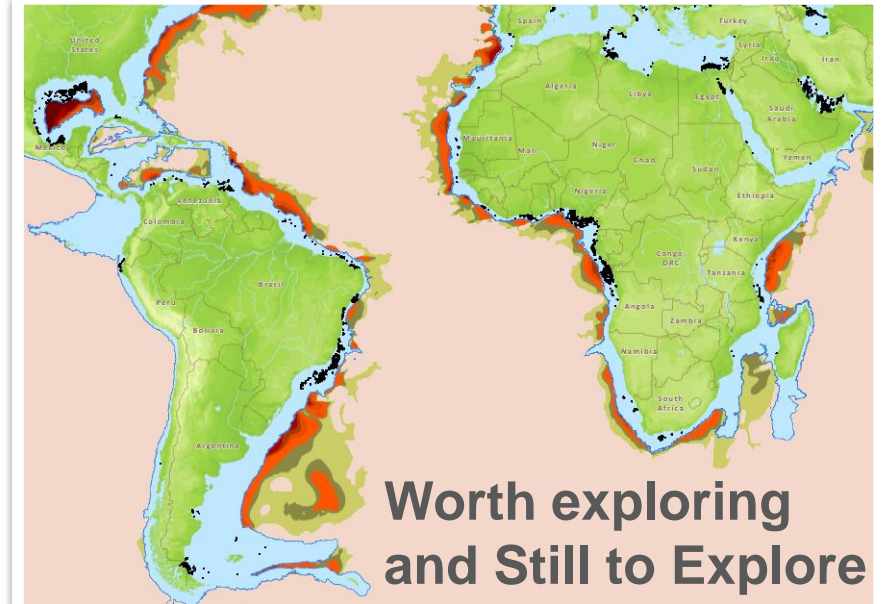


UDW in \$50 Oil



- low oil price = cheap UDW wells
- UDW is Doable – just need to ask
- The world biggest undrilled oil prospects are in the UDW Arena

Conclusion



- UDW is the goal – we've only started the journey

- \$50 Oil is the catalyst we need to access the UDW apron fan play

Big, low risk prospects, with cheap rigs; lets go get it