

# Lansdowne

oil & gas

## The North Celtic Sea Basin – A Resurgent Proven Hydrocarbon Province



Geoscience Wales

November 2014

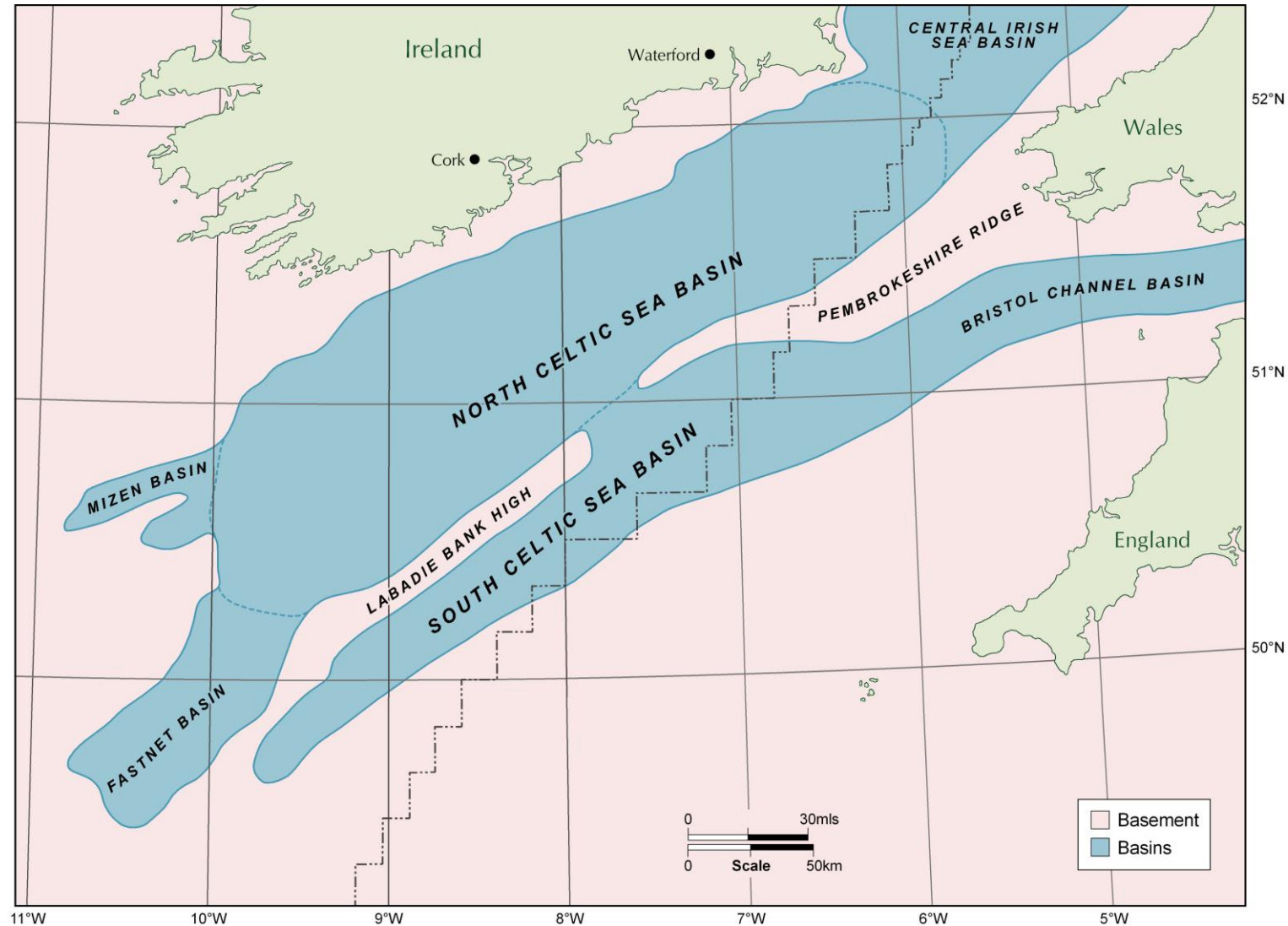
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# Why the Celtic Sea?

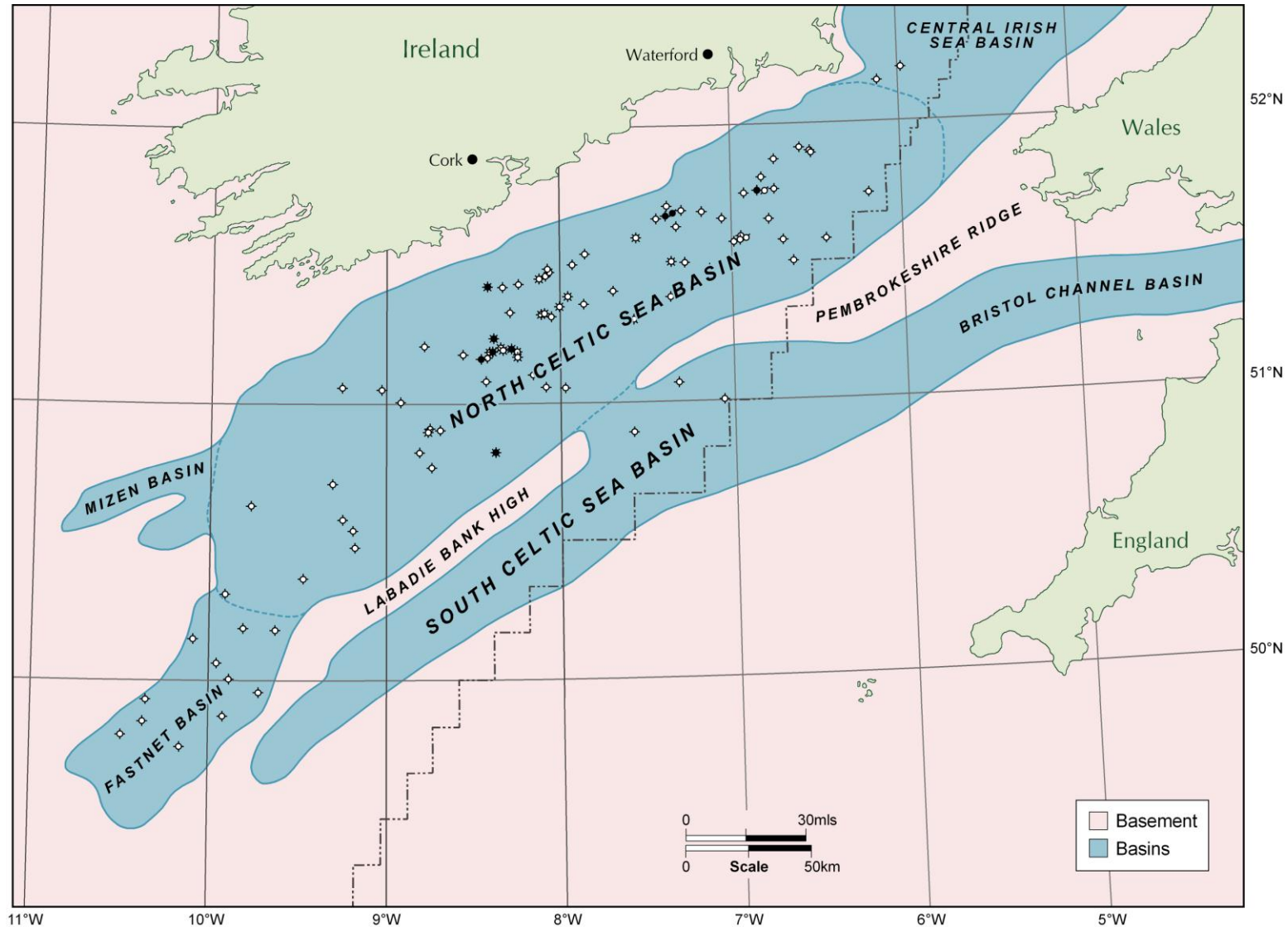
- **Underexplored**
- **Proven Petroleum Systems**
- **Prospects**
- **Infrastructure**

# Underexplored – Basin definition

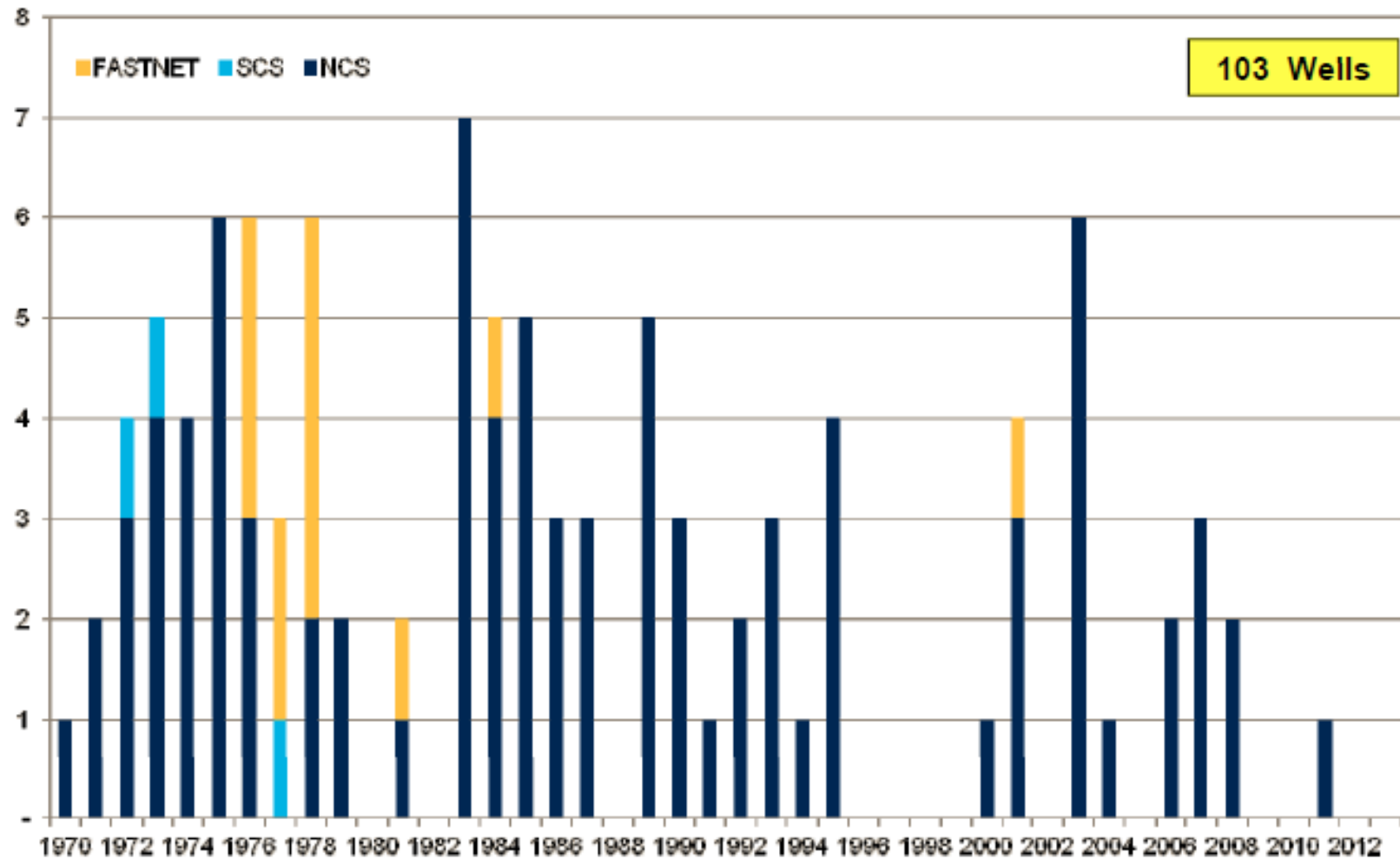




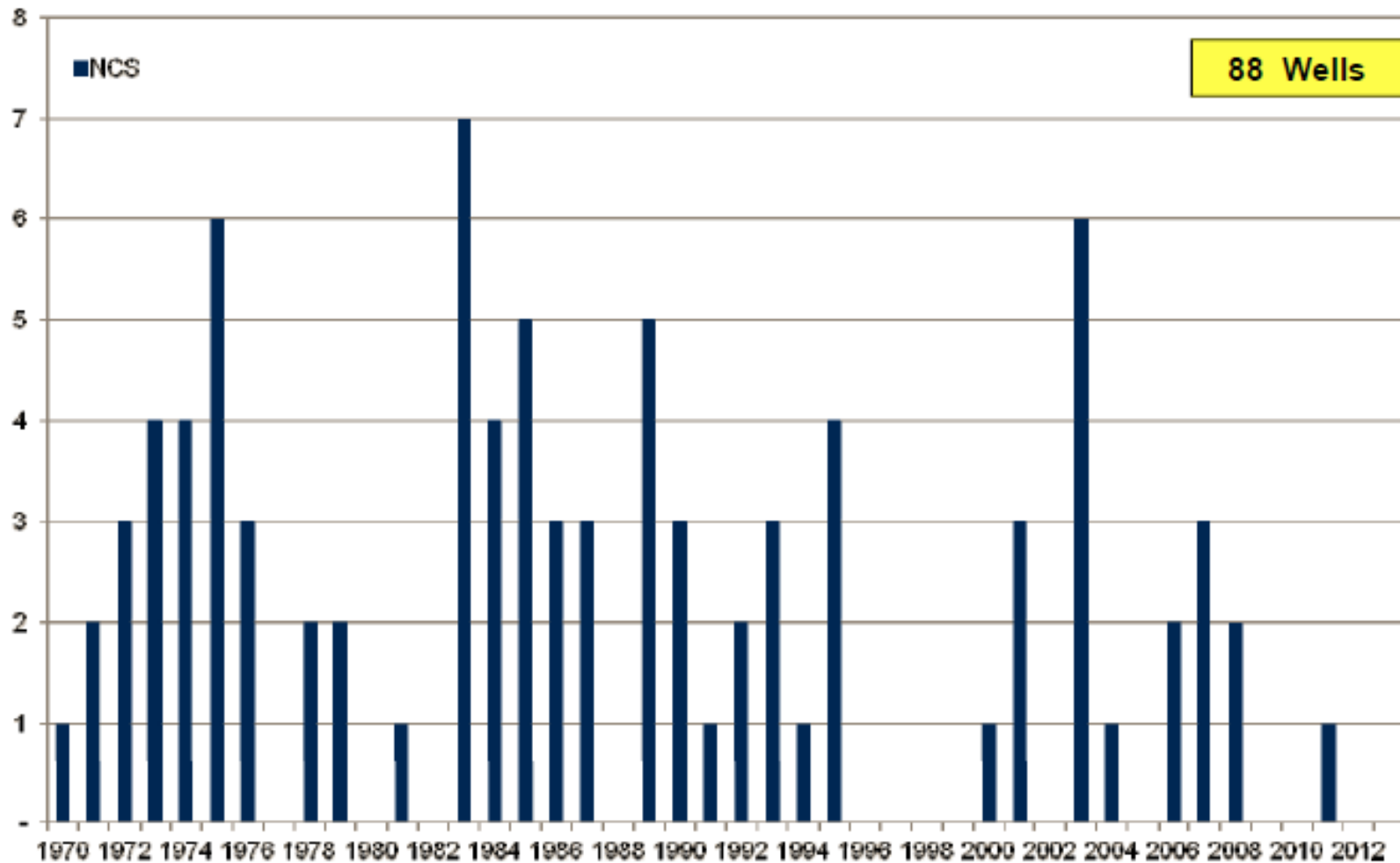
# Underexplored – well distribution



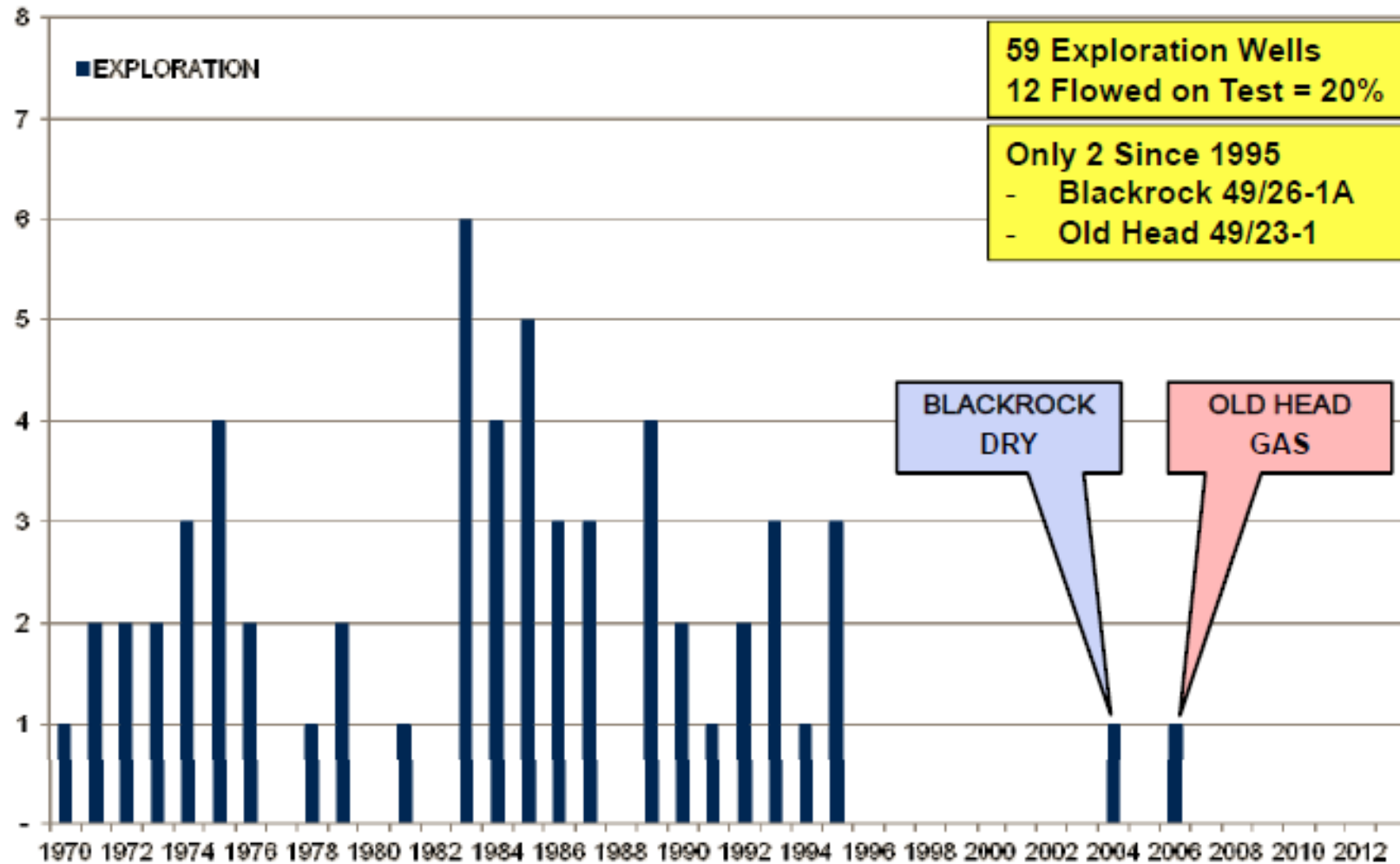
# Underexplored – all wells



# Underexplored – NCSB only

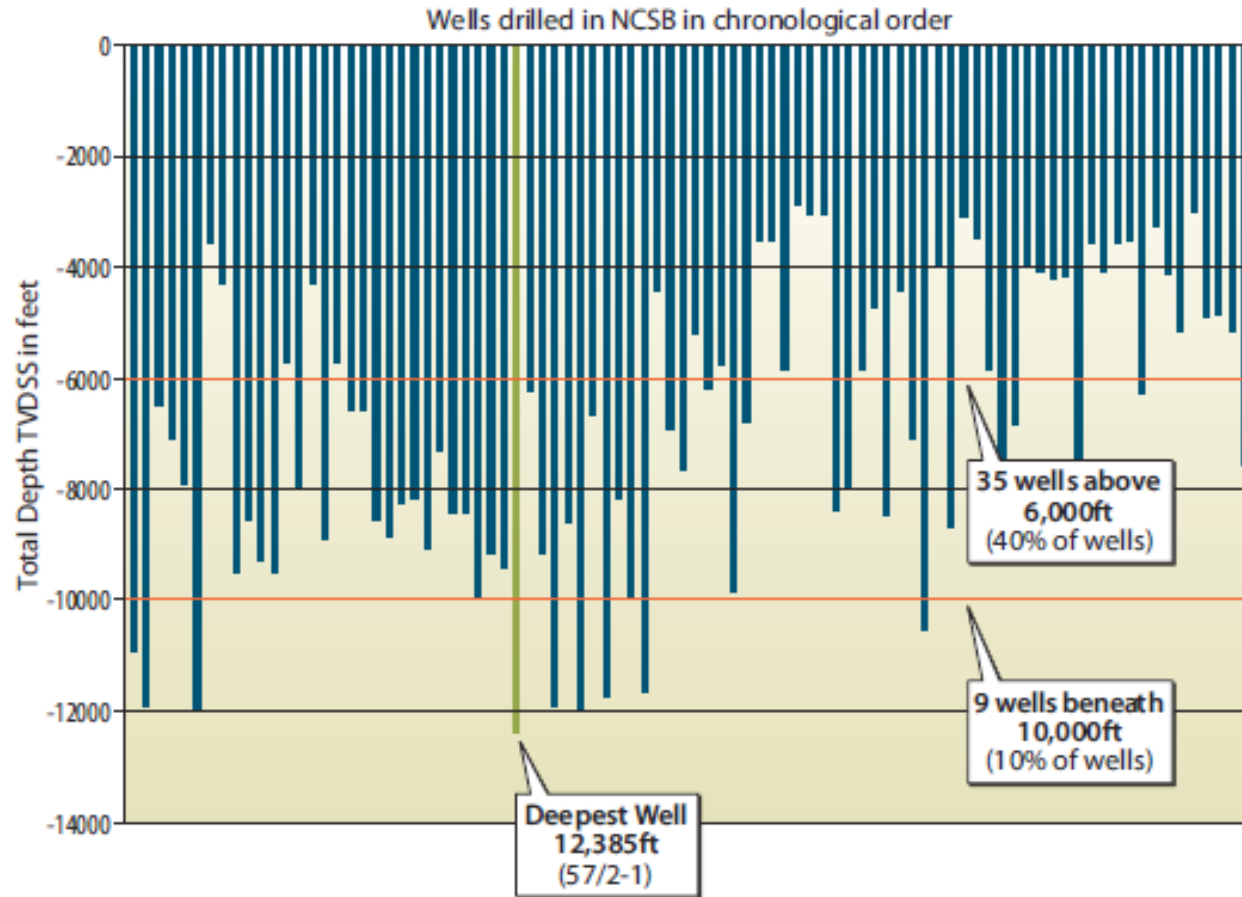


# Underexplored – NCSB Exploration wells only



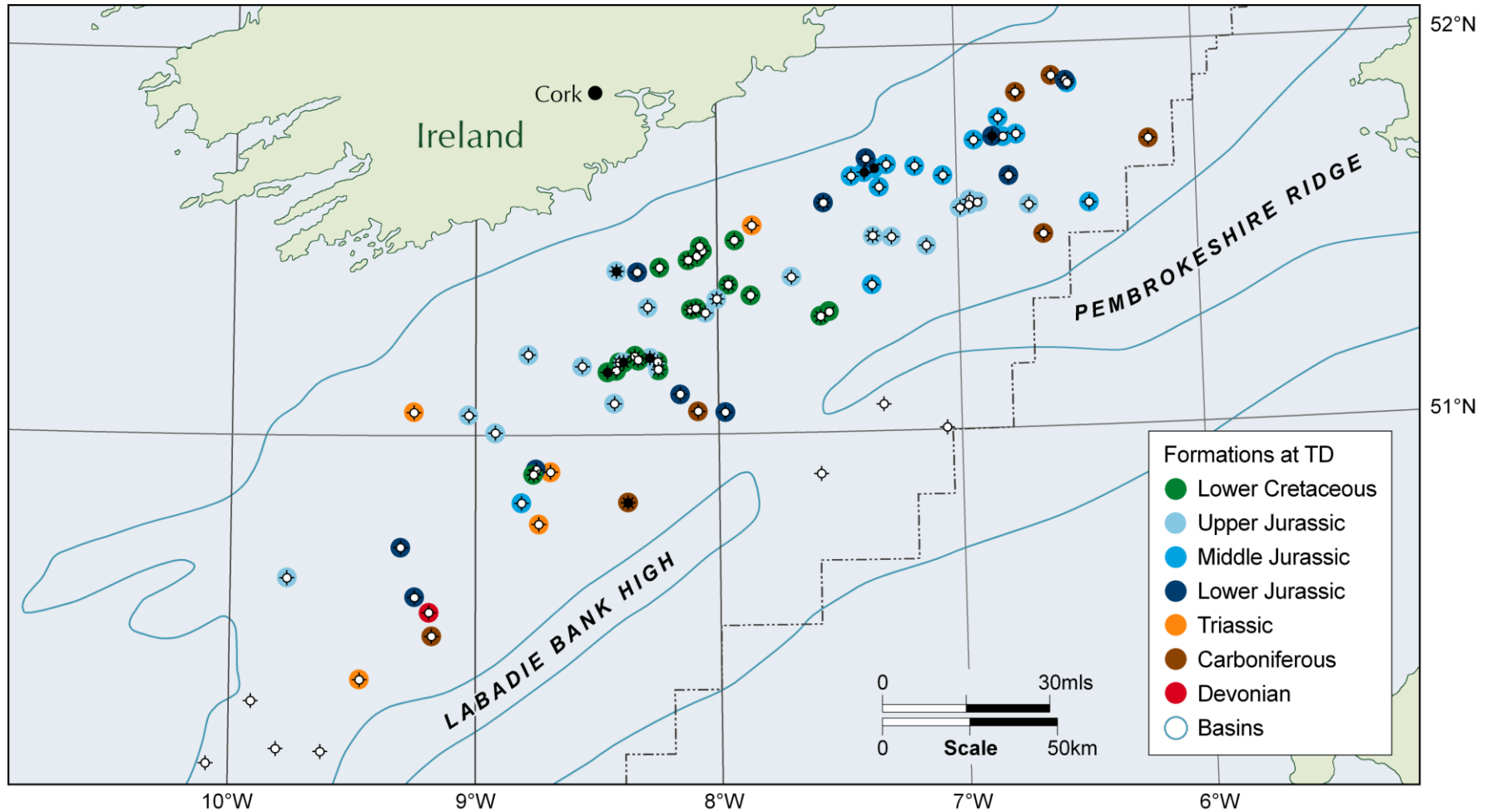
# Underexplored – all wells drilling depth

## North Celtic Sea Basin – Drilling Depths

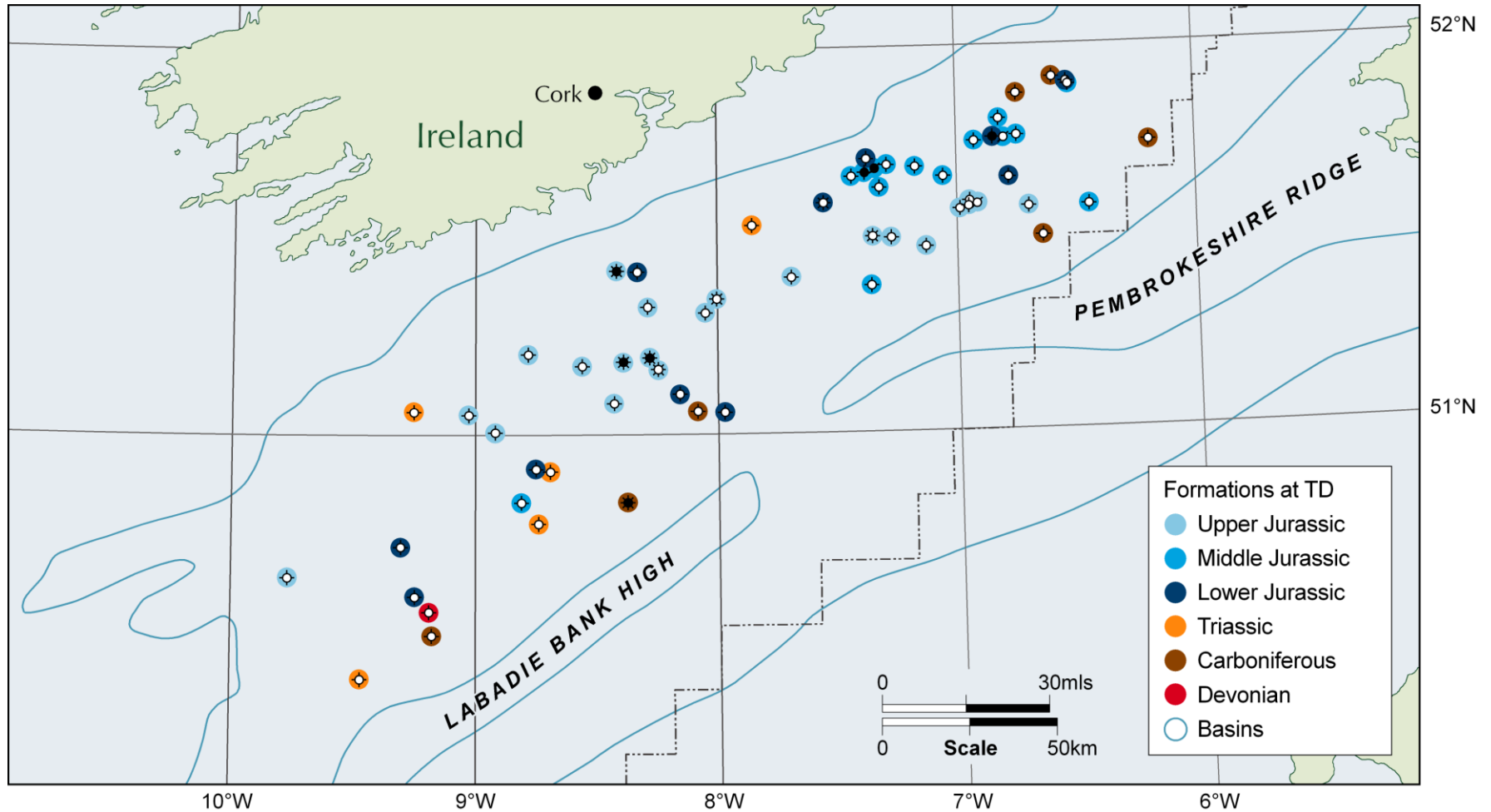




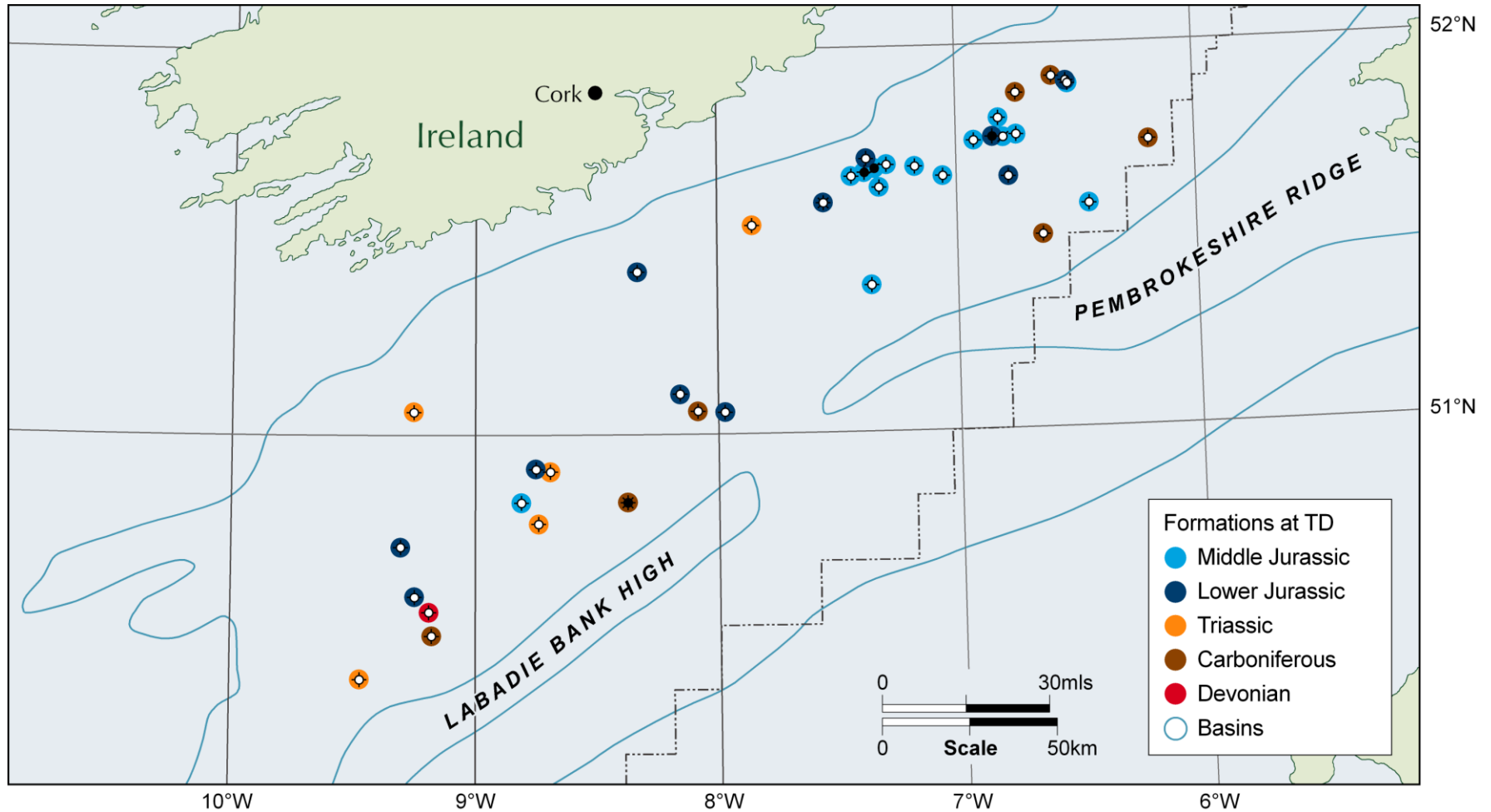
# Underexplored – all wells formation at TD



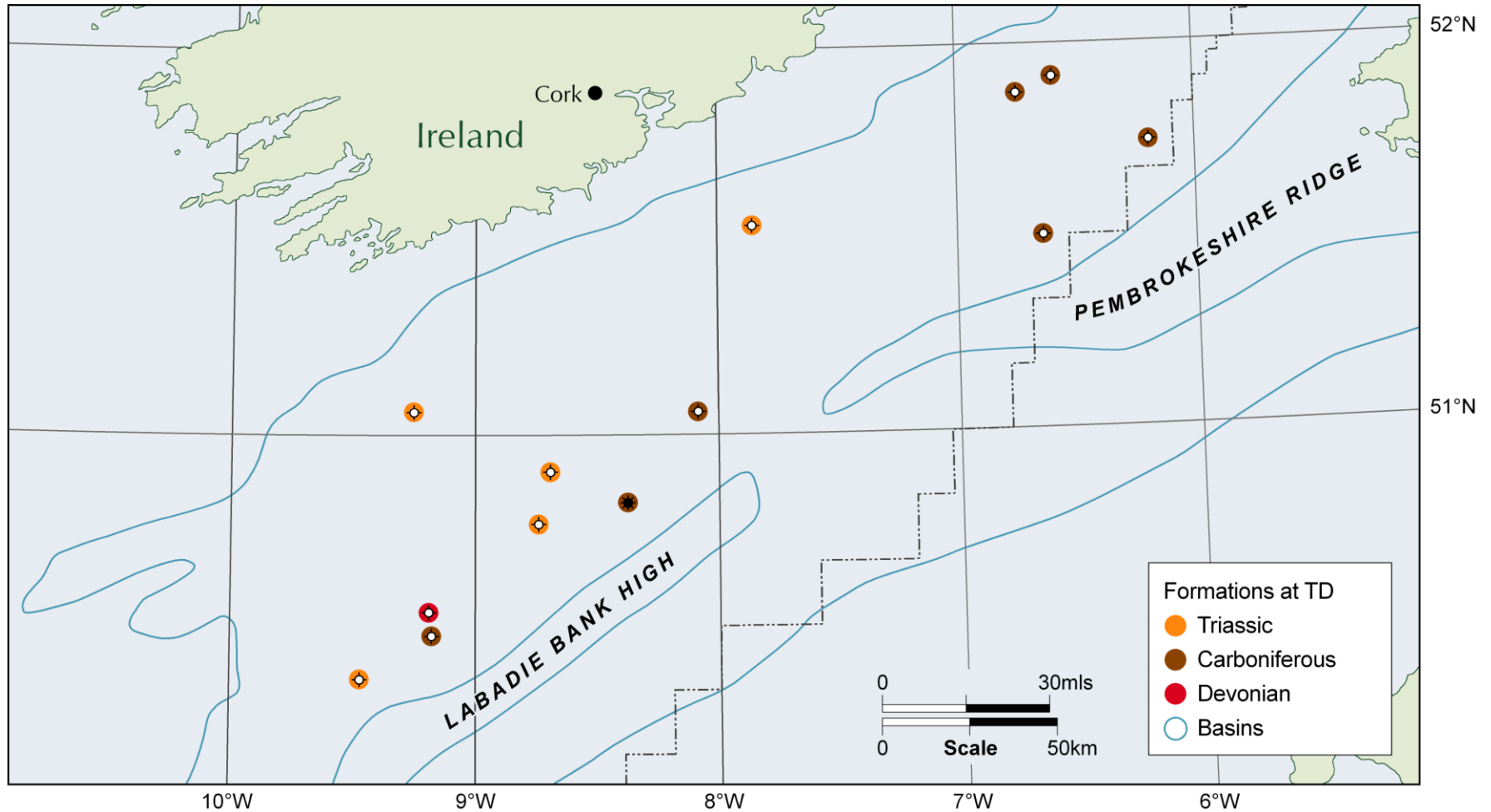
# Underexplored – wells Jurassic/older at TD



# Underexplored – wells Middle Jurassic/older TD



# Underexplored – wells Triassic/older at TD



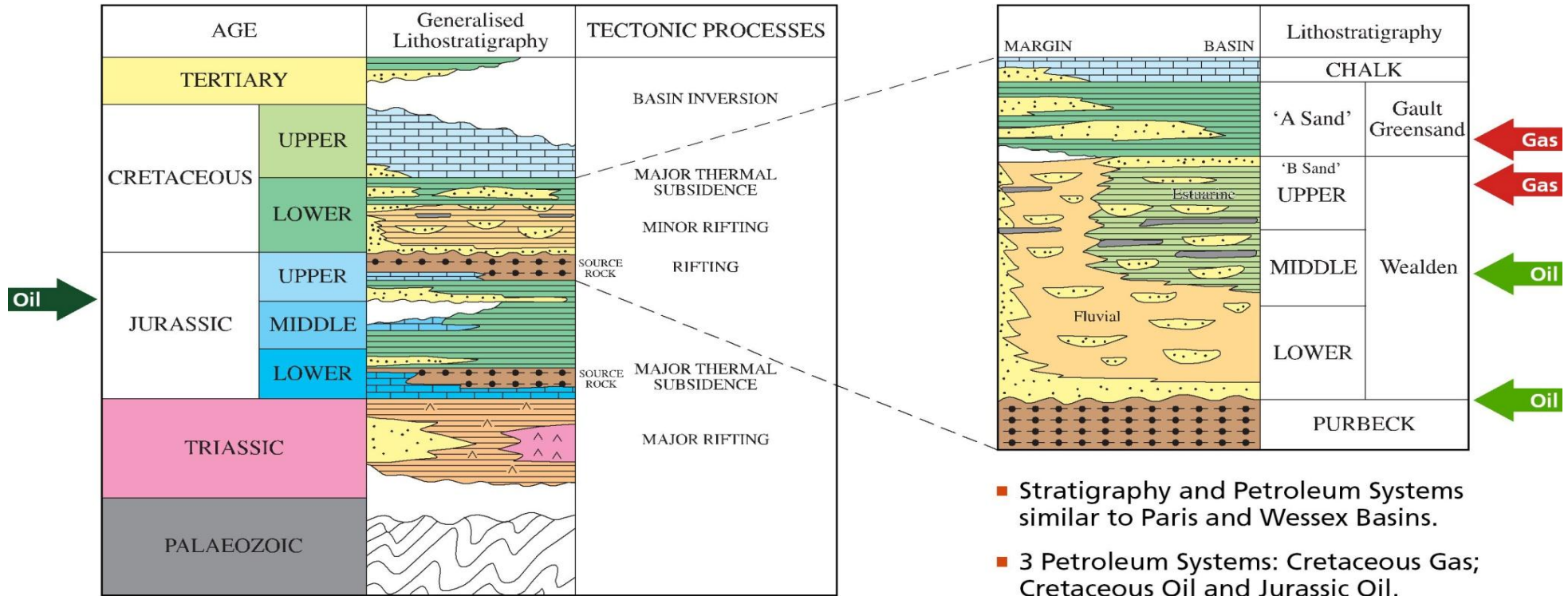
# Why the Celtic Sea?

- Underexplored
- **Proven Petroleum Systems**
- **Prospects**
- **Infrastructure**



# Celtic Sea Petroleum Systems


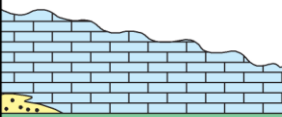
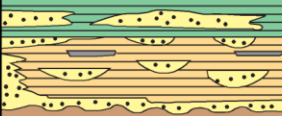
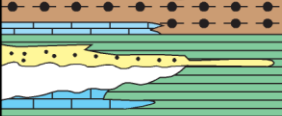
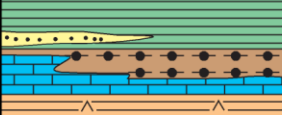
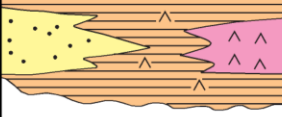


## Celtic Sea – Stratigraphy



After Shannon (1991), Rowell (1995) and O'Sullivan (2001)

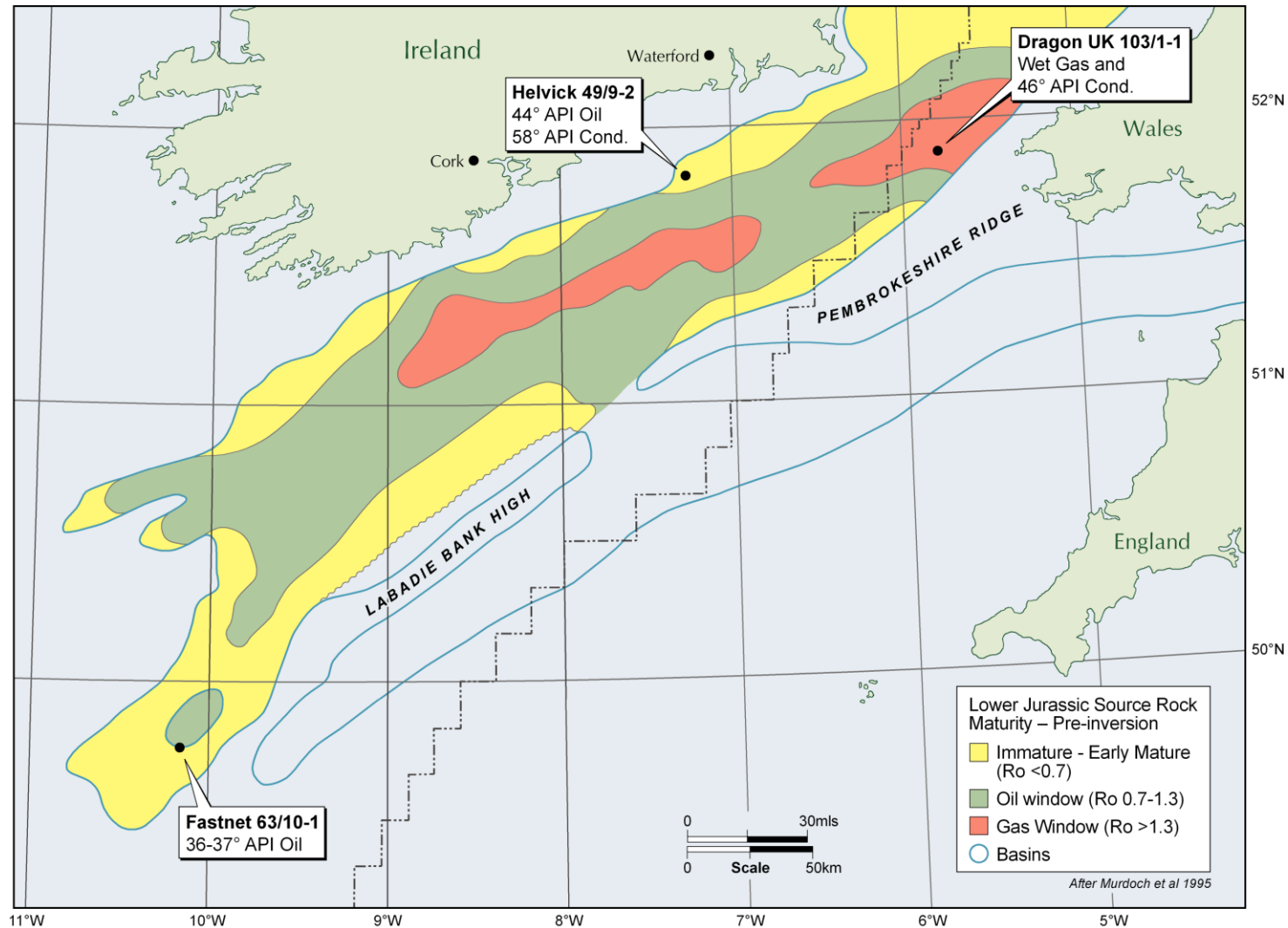
- Stratigraphy and Petroleum Systems similar to Paris and Wessex Basins.
- 3 Petroleum Systems: Cretaceous Gas; Cretaceous Oil and Jurassic Oil.

# Petroleum Systems – Source Rocks

Age		Generalised Lithostratigraphy	Source Rocks	Hydrocarbon Type	Discoveries
TERTIARY					
CRETACEOUS	Upper				
	Lower		Wealden Coals	Biogenic dry gas	Kinsale Head, Ballycotton, Seven Heads Galley Head, Carrigaline, Old Head, Schull
JURASSIC	Upper		Purbeck – Kimmeridgian Lacustrine Shales	Waxy oil	Barryroe, Hook Head, Baltimore, Nemo, 49/9-4
	Middle				
	Lower		Lower Jurassic (Liassic) Marine Shales	"Normal" non-waxy oil and wet gas / condensate	Helvick, 63/10-1 Dragon
TRIASSIC					
PALAEOZOIC					

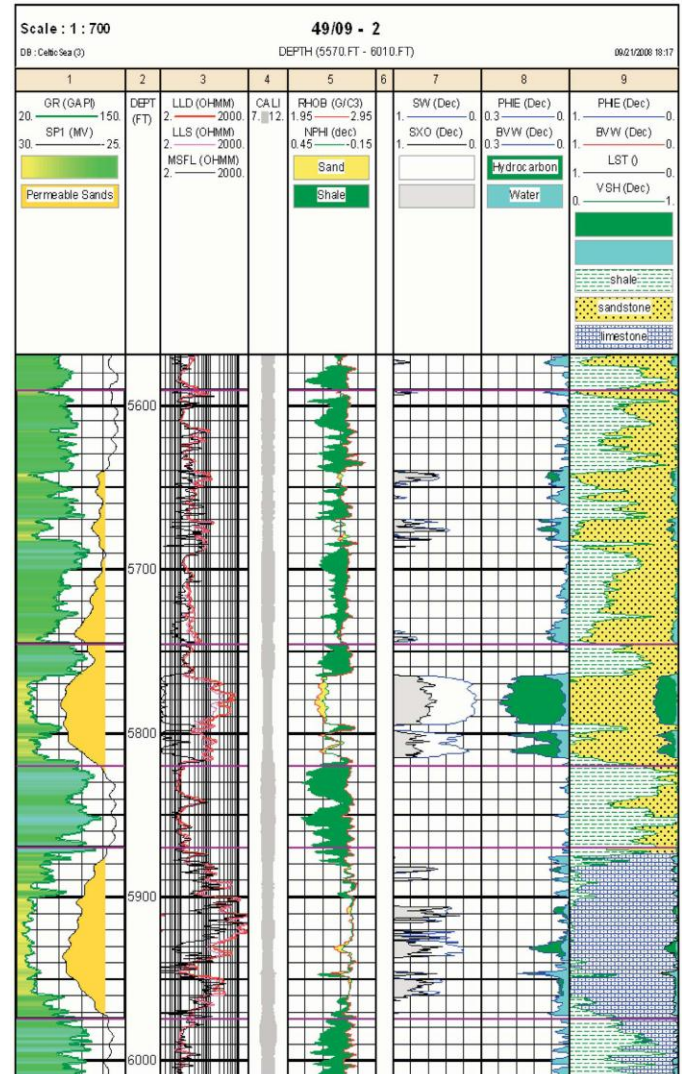
*After Shannon (1991), Rowell (1995) and O'Sullivan (2001)*

# Jurassic Source Rocks & Discoveries



# Helvick Oil Field

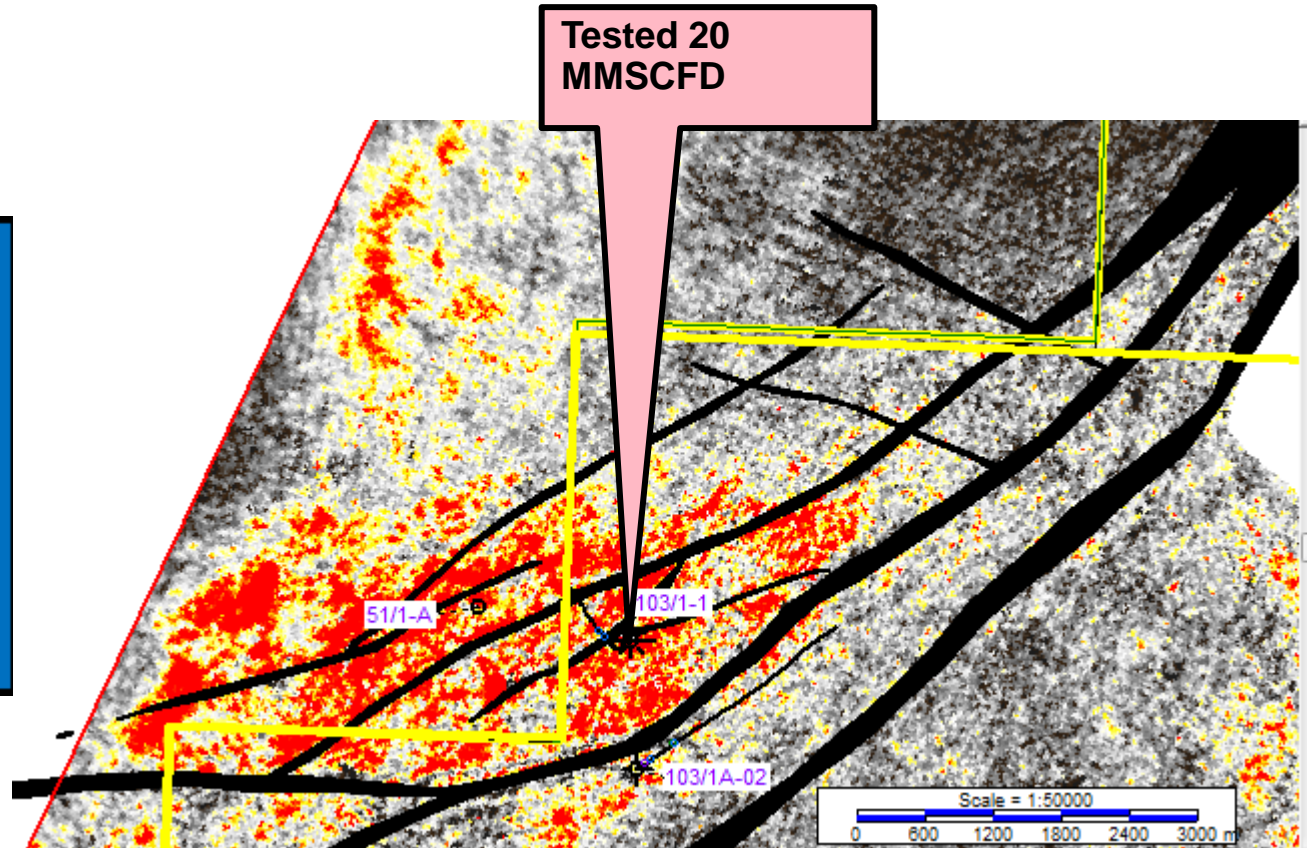
- Helvick (49/9-2 well) discovery opened up Jurassic Oil Play Fairway along northern margin of the basin
  - High deliverability (cumulative 9901 bopd) reservoir sands
  - Good quality, light (44 API) and non-waxy oil sourced from Lower Jurassic (Liassic) source rocks





# Dragon Gas Condensate Field

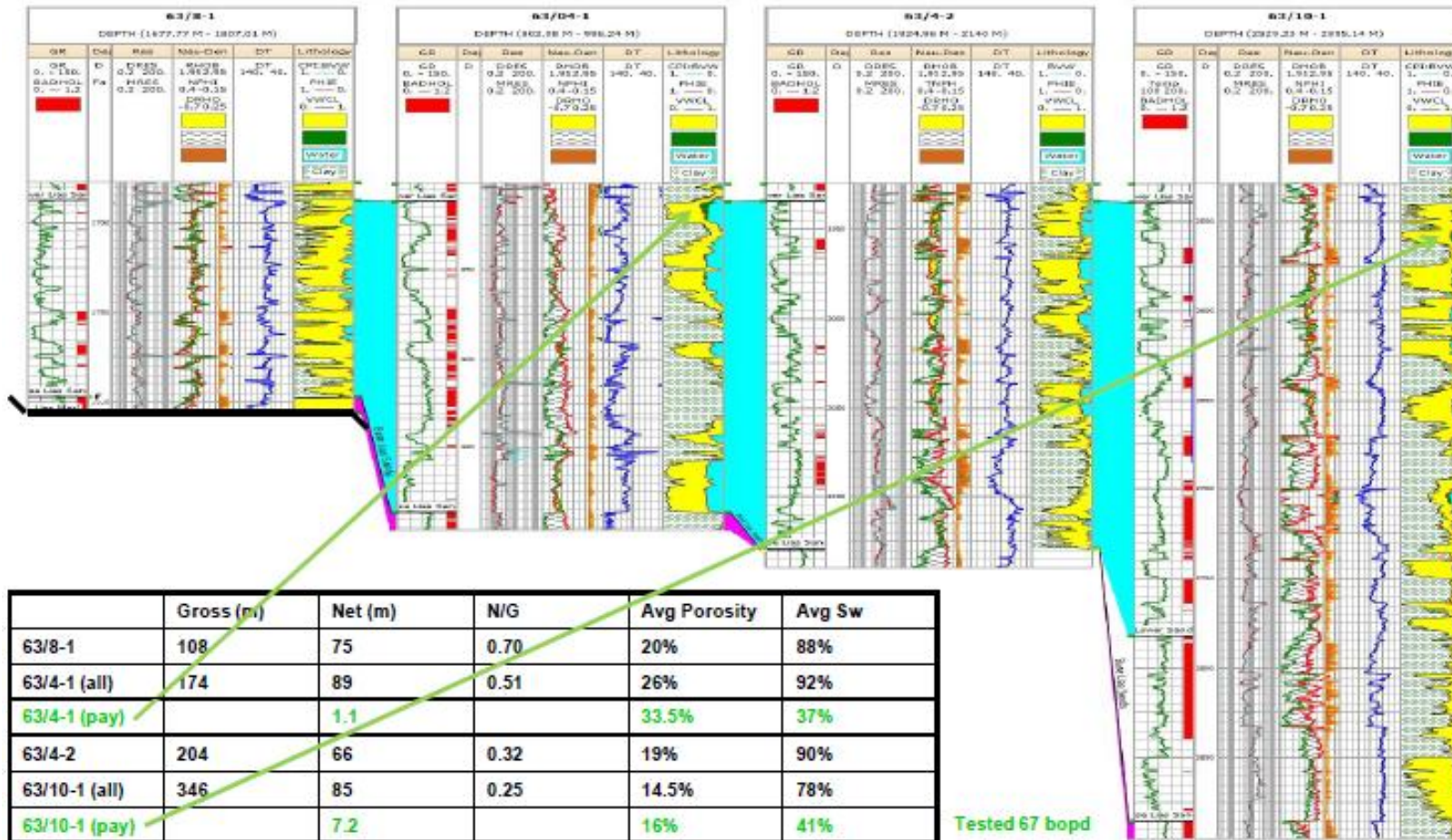
Basin – St George's Channel  
Basin  
Distance - 70 Km offshore  
Water Depth - 100m  
Reservoir Depth – 2,500m  
Reservoir Age – Upper Jurassic  
Reservoir Type– Fluvial/Alluvial  
Trap Type - Structural  
Fluid Type – Gas  
REC Estimate – 200 BCF



3D Seismic Amplitude Display

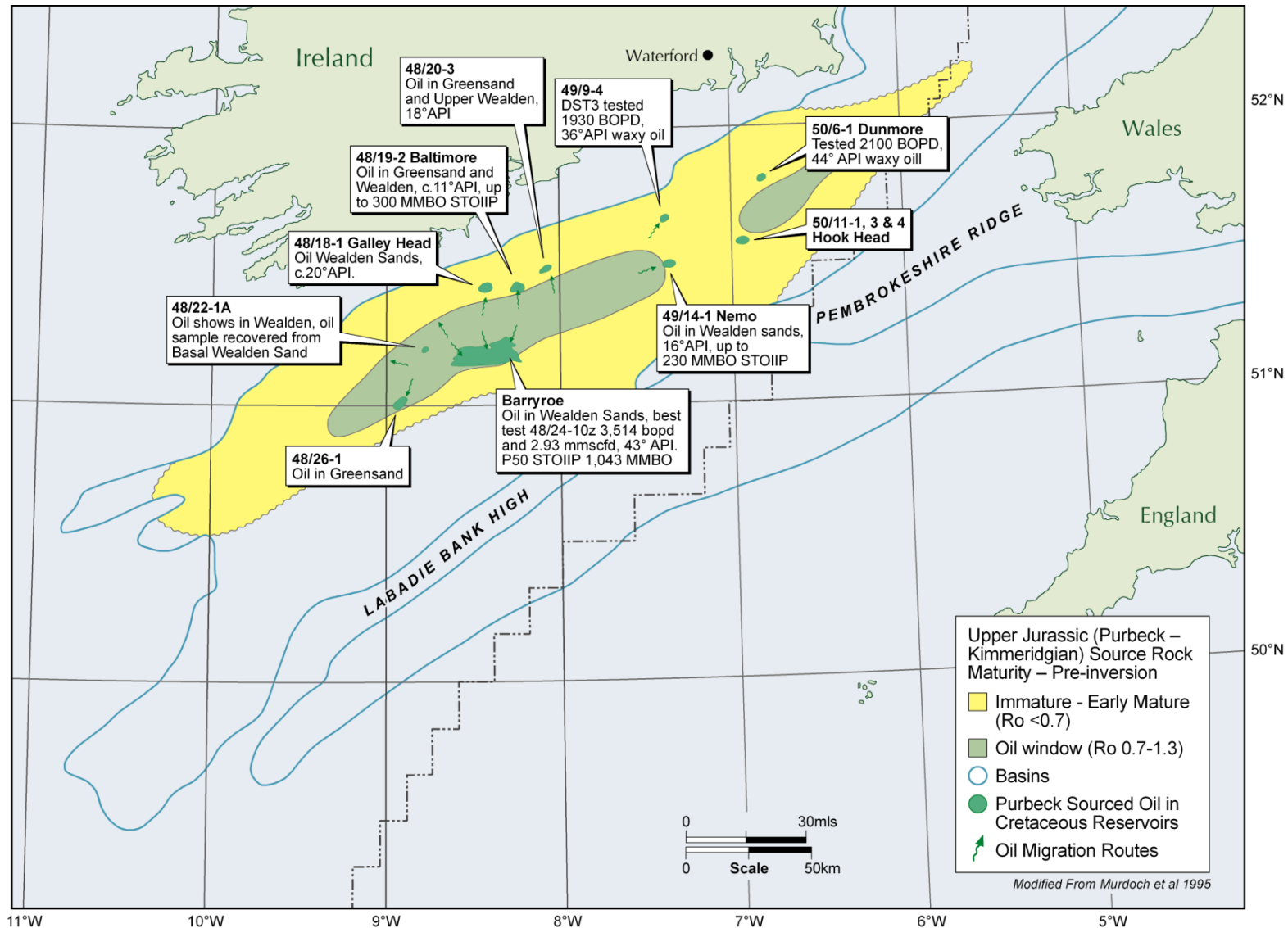


# Fastnet – 63/10-1 Discovery – Liassic Sands

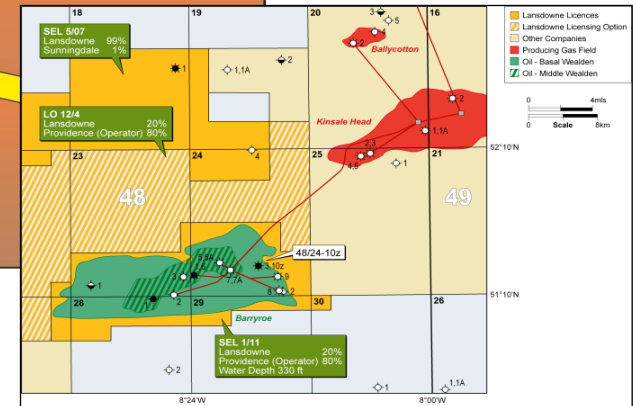
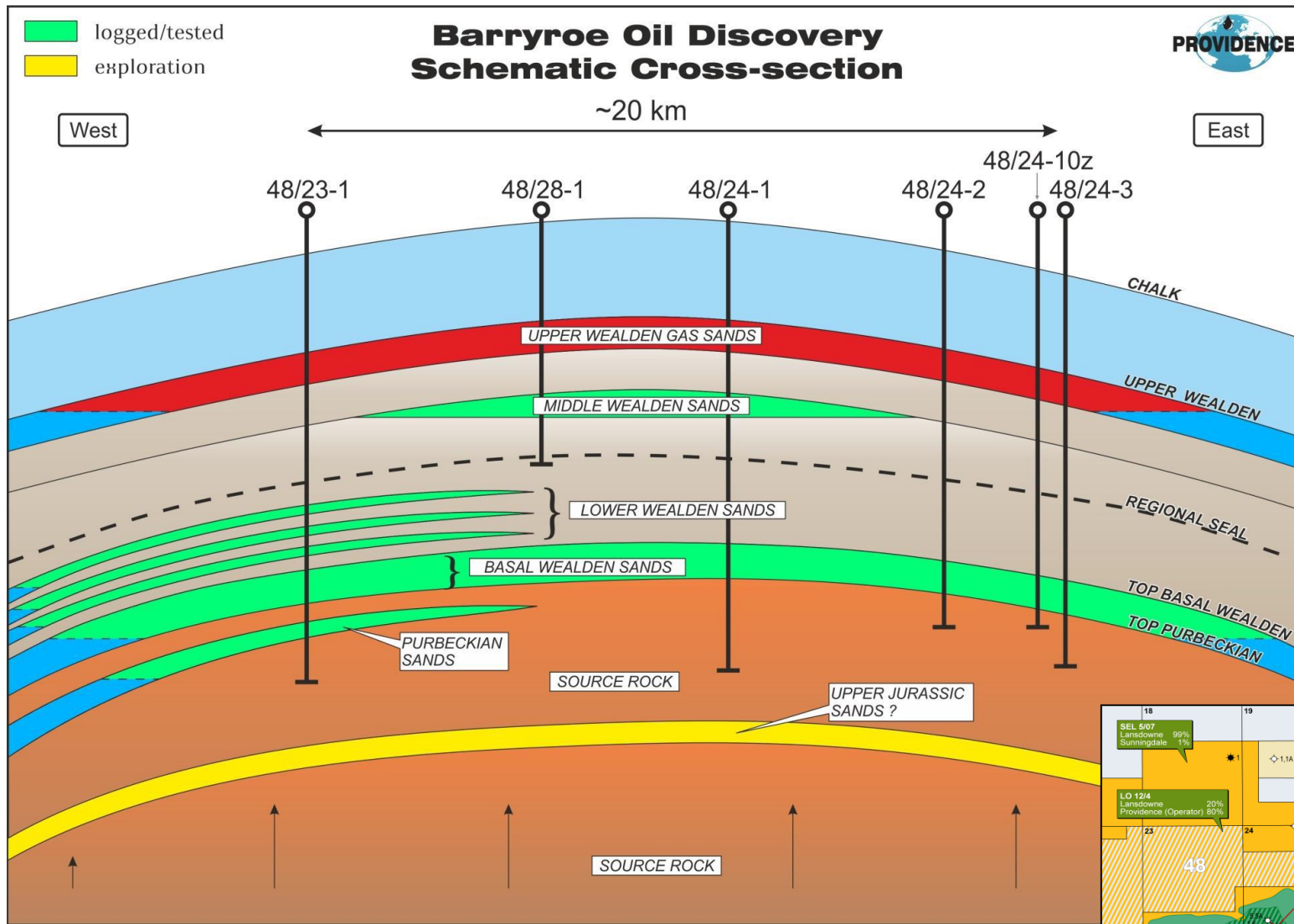


Source: Fastnet Petroleum Limited

# Purbeck- Wealden Oil Play & Discoveries



# Barryroe Oil Field



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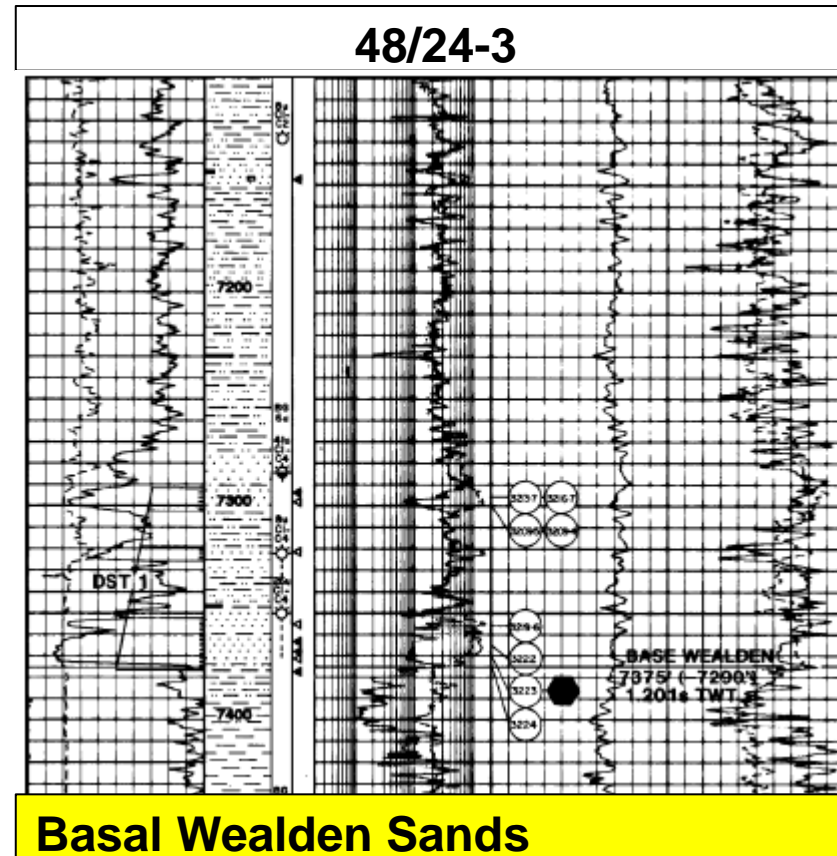


# Barryroe Oil Field

Properties	48/24-10z
Oil	43° API
Wax Content	17%
In-situ viscosity	0.8 cP
GOR	c. 800
Flow rate	3,514 bopd & 2.93 mmscfd



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# Barryroe Oil Field – Wealden Sands Swanage





# Barryroe Oil Field – Wealden Sands Swanage





# Barryroe Oil Field – Wealden Sands Swanage



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# Barryroe Oil Field - palaeogeography



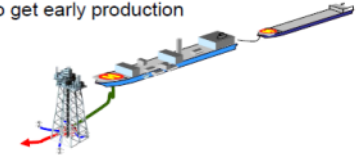
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# Barryroe – Forward Plan

- Providence Resources launched a farm-out process on behalf of the Barryroe partnership during 2013.
- Subject to further appraisal, it is currently envisaged that Barryroe will be developed in two phases with first oil being achieved before the end of the decade.
- Phase 1 would target an area containing around 70 mmbbl and produce up to 30,000 b/d through a leased FPSO or a small wellhead platform.
- Phase 2 would involve a full field development, ultimately utilising up to three fixed platforms. These would target incremental resources of about 240 mmbbl and produce up to 100,000 b/d.

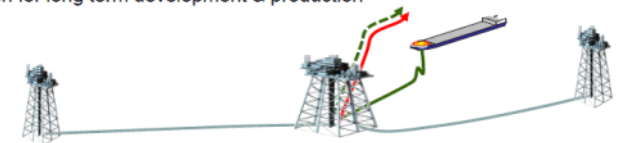
## Phase 1 : First Phase Production System

- Core Area Appraisal/pre-Development Drilling
- Leased Floating Solution or small WHP/FSO to get early production
- 30,000 BOPD peak rate



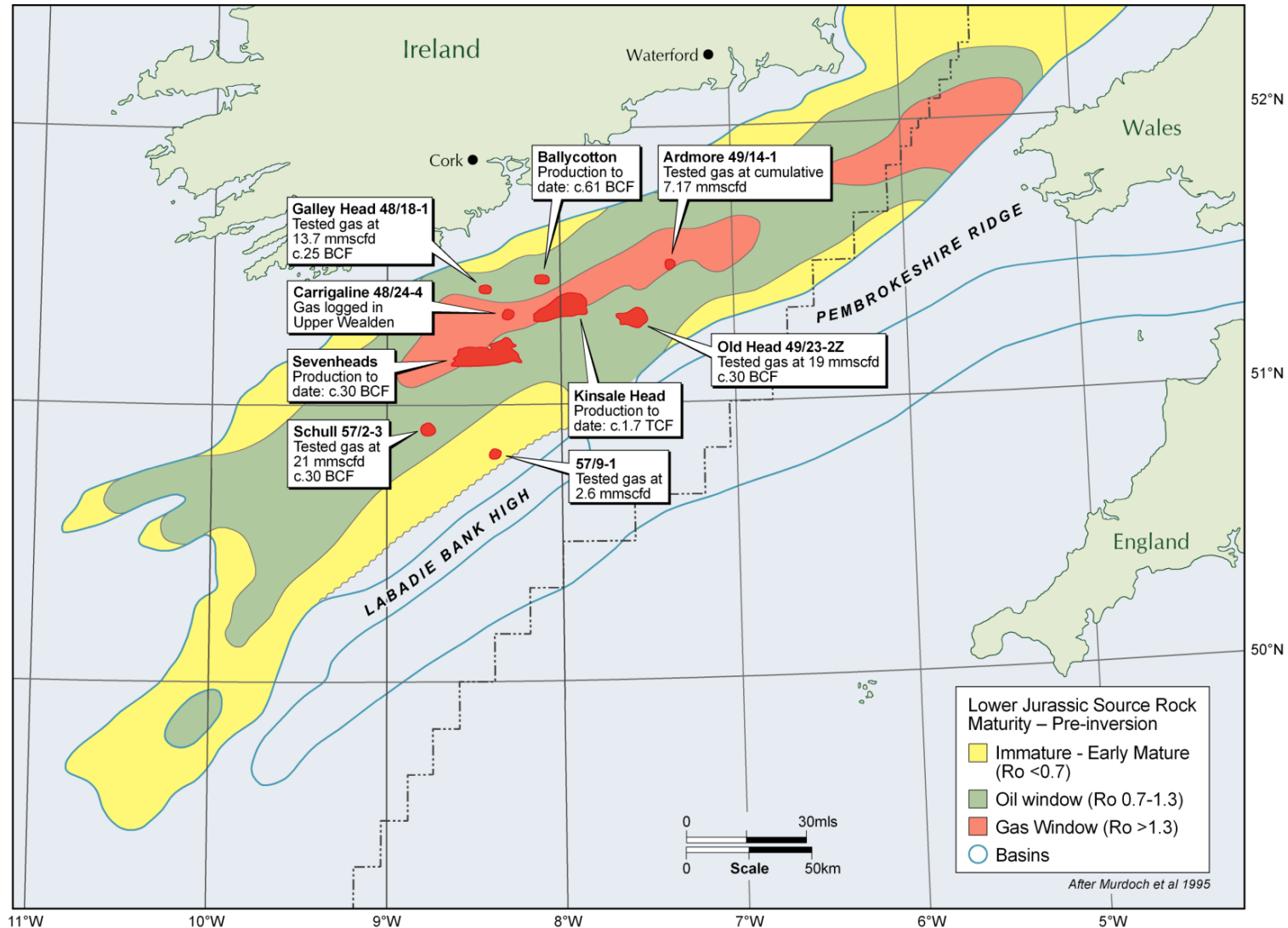
## Phase 2 : Full Field Development

- Full field Appraisal/Development
- Phased Fixed Platform Solution for long term development & production
- 100,000 BOPD peak rate

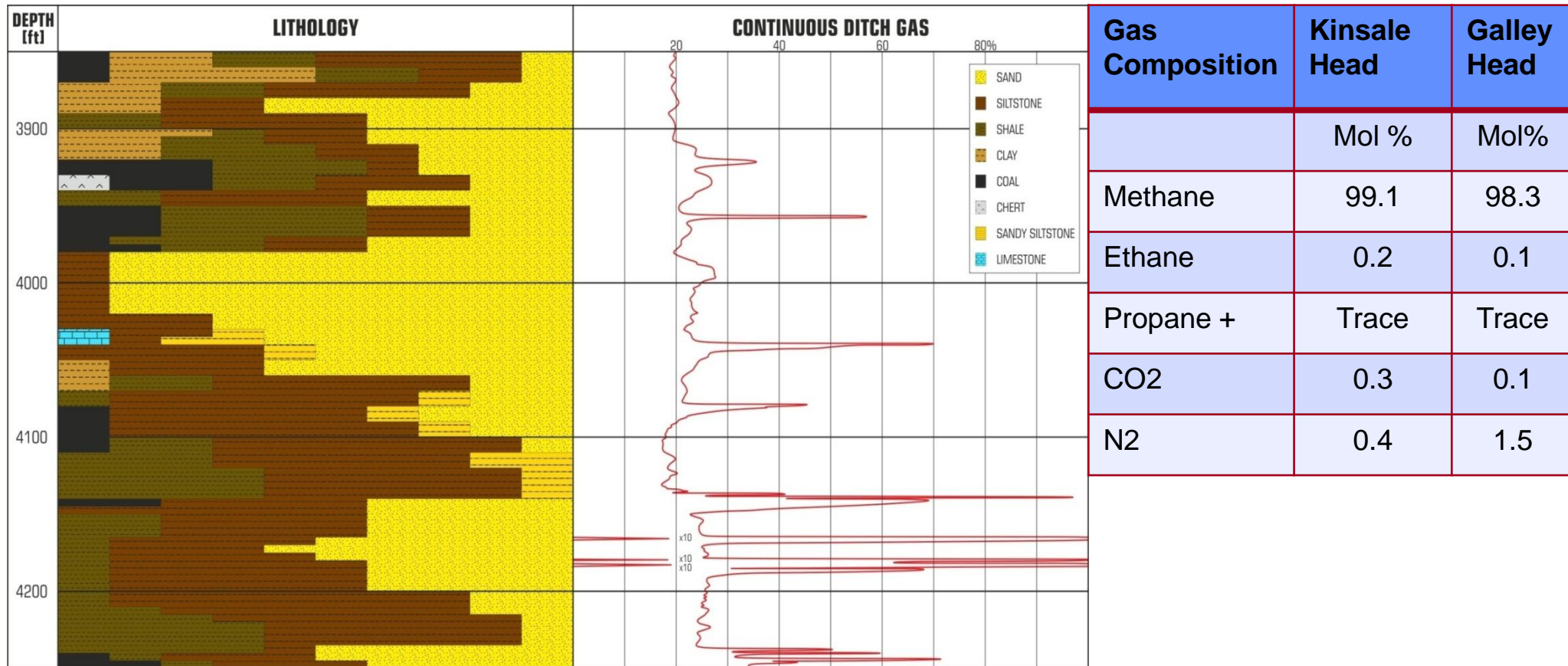


Barryroe contingent resources (mmboe)	1C	2C	3C
Middle / Lower Wealden oil	4	45	113
Basal Wealden oil	85	266	511
Gas	12	35	90
<b>Total gross</b>	<b>101</b>	<b>346</b>	<b>714</b>
Net to Lansdowne	20	69	143

# Cretaceous Gas Play & Discoveries



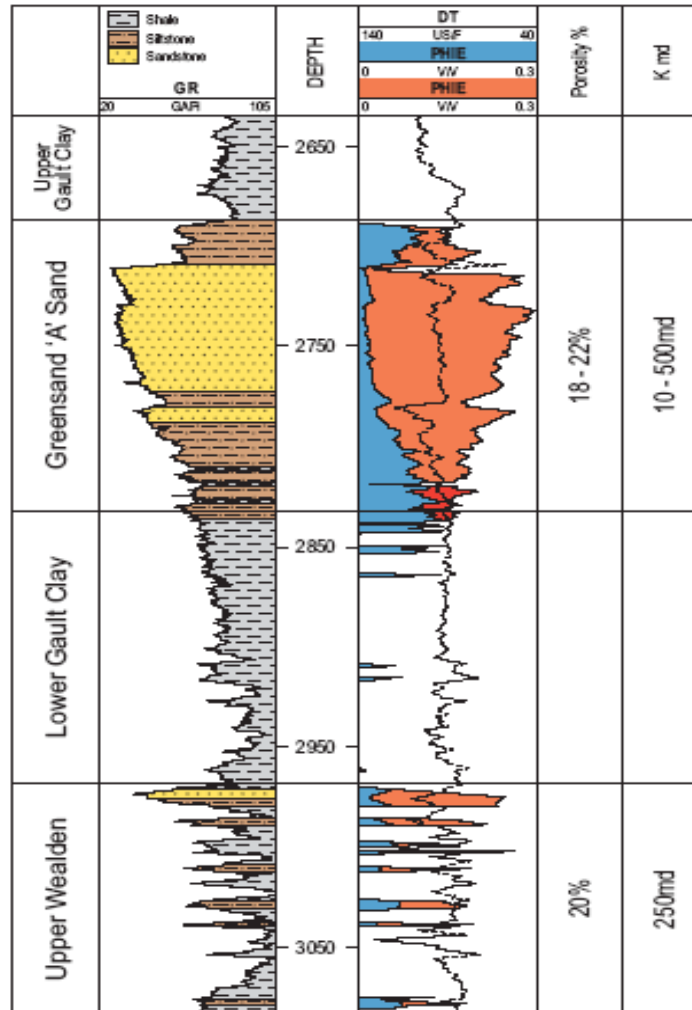
# Source - Well 48/25-2 Mudlog Gas Shows





# Cretaceous Gas Play – Reservoirs

Kinsale Area Type Log



**Primary Target**

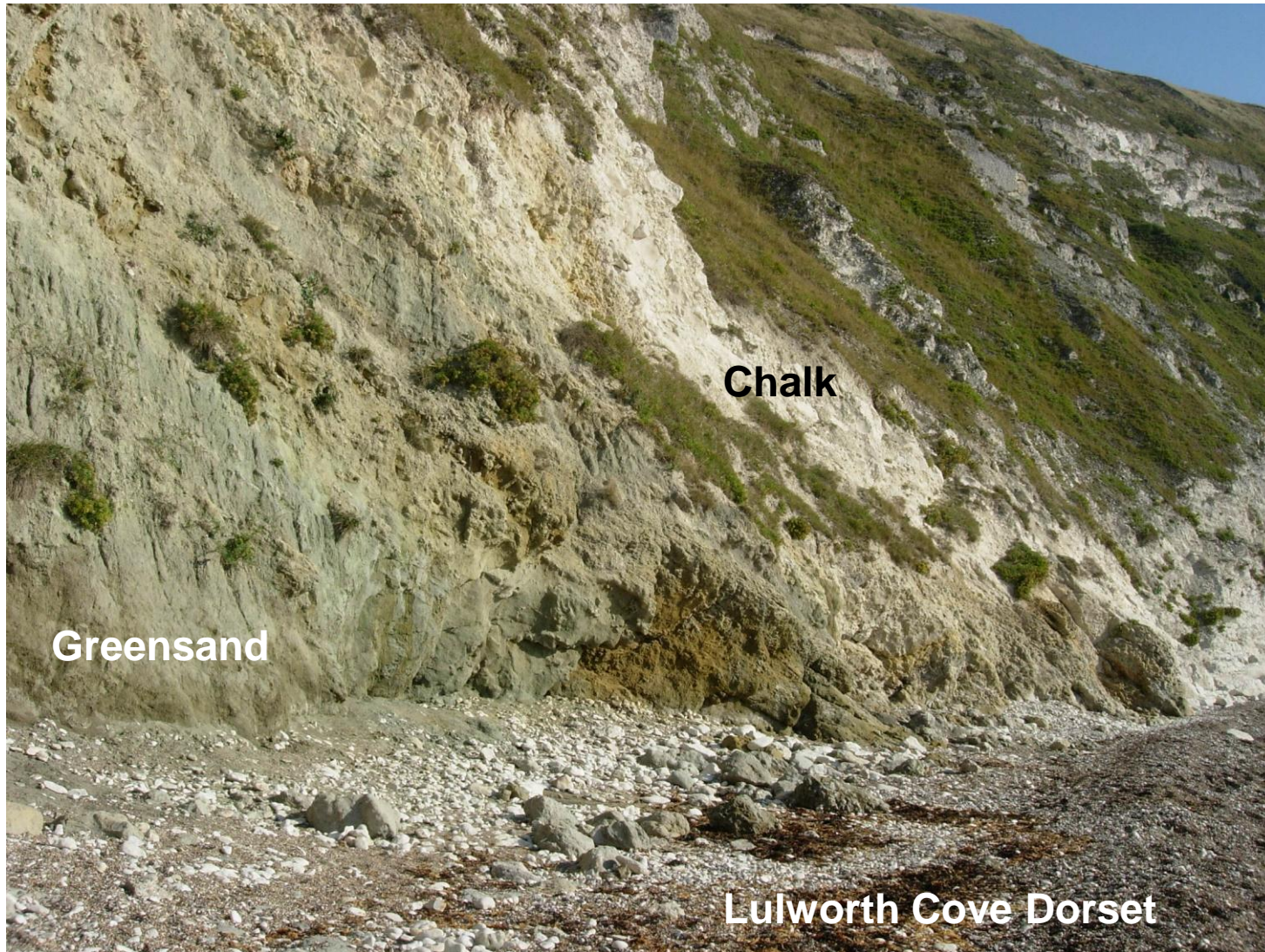
**Secondary Target**

Greensand or A Sand	
Producing	Kinsale Ballycotton
Discoveries	Galley Head
Target	Rosscarbery Midleton East Kinsale

Upper Wealden	
Producing	Kinsale Seven Heads
Discoveries	Old Head, Schull, Carrigaline, Ardmore
Target	Rosscarbery East Kinsale



# Greensand Reservoir Model





# Greensand Reservoir Model



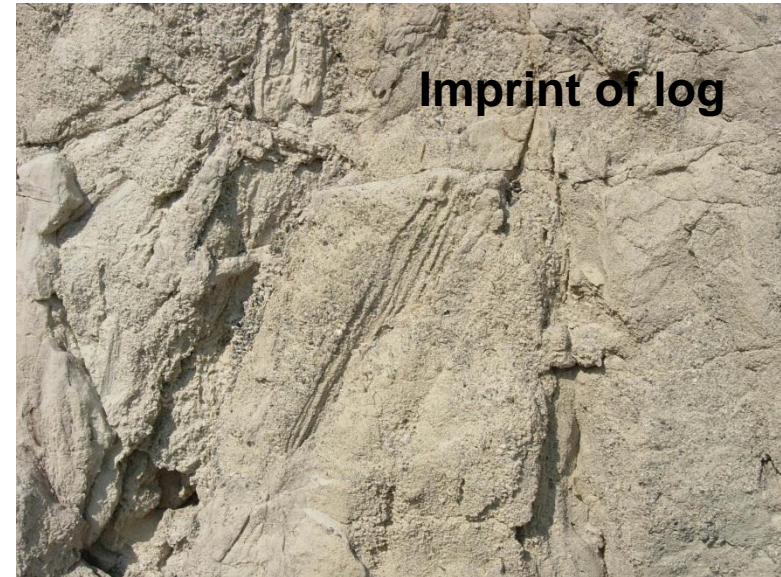
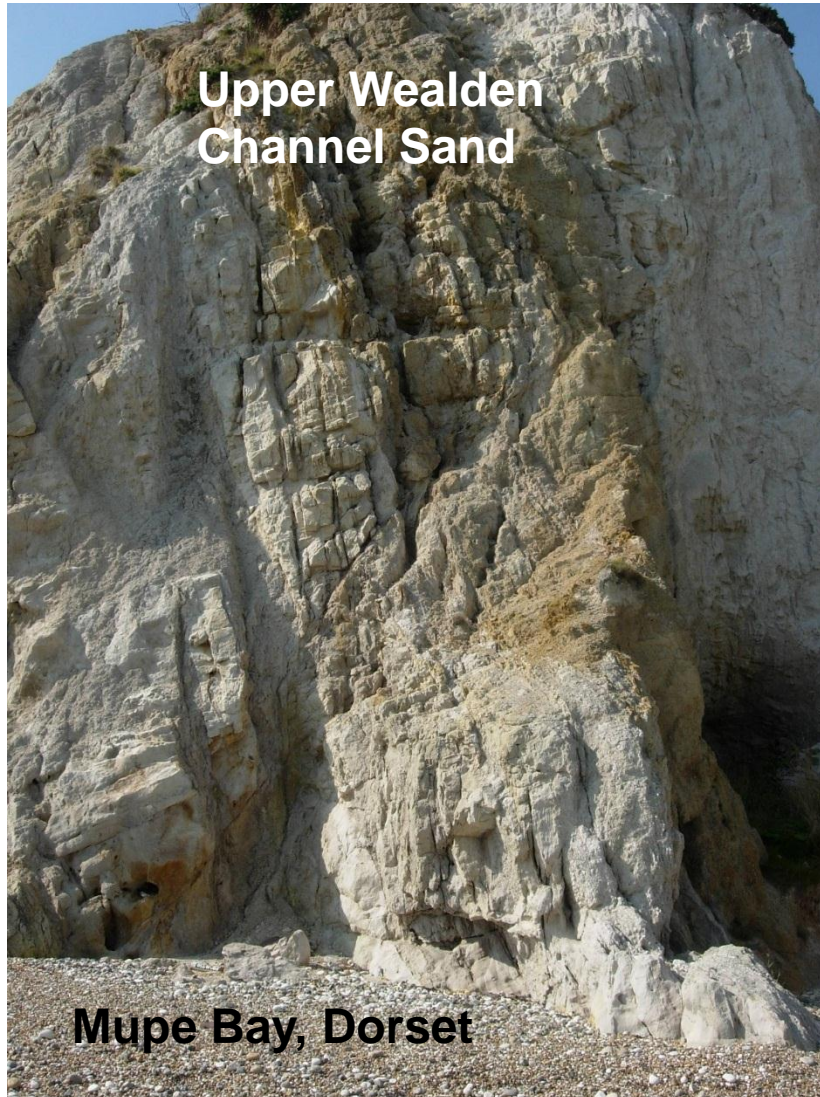


# Upper Wealden Reservoir Model

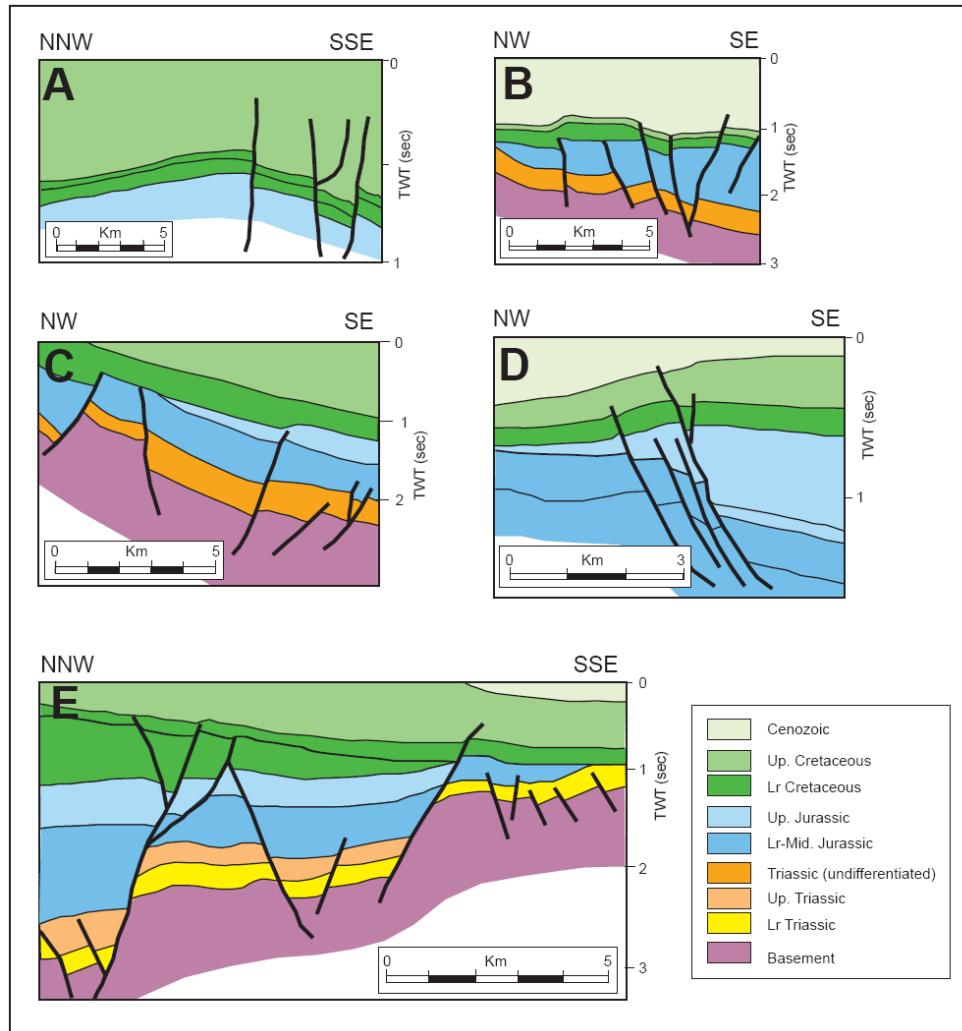




# Upper Wealden Reservoir Model



# Structures



## Schematic Illustration of Play and Traps Types in the Celtic Sea Basins

(Naylor & Shannon 2011)



# Structures



Stair Hole, Lulworth, Dorset

Source: Merlin Energy Resources



# Structures

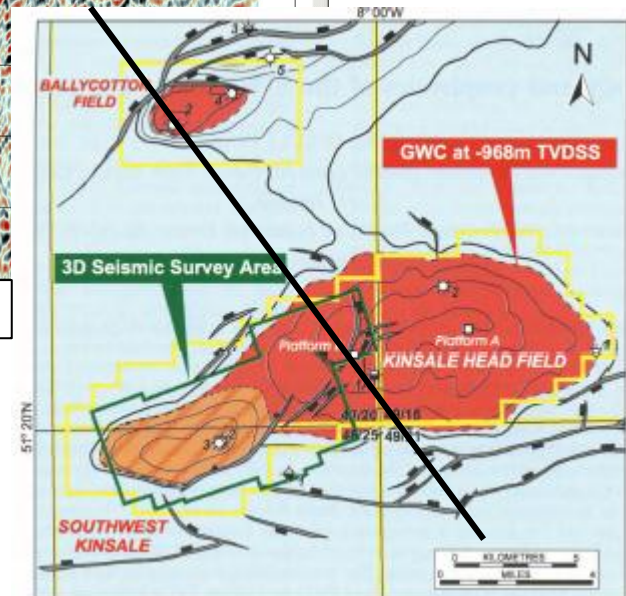
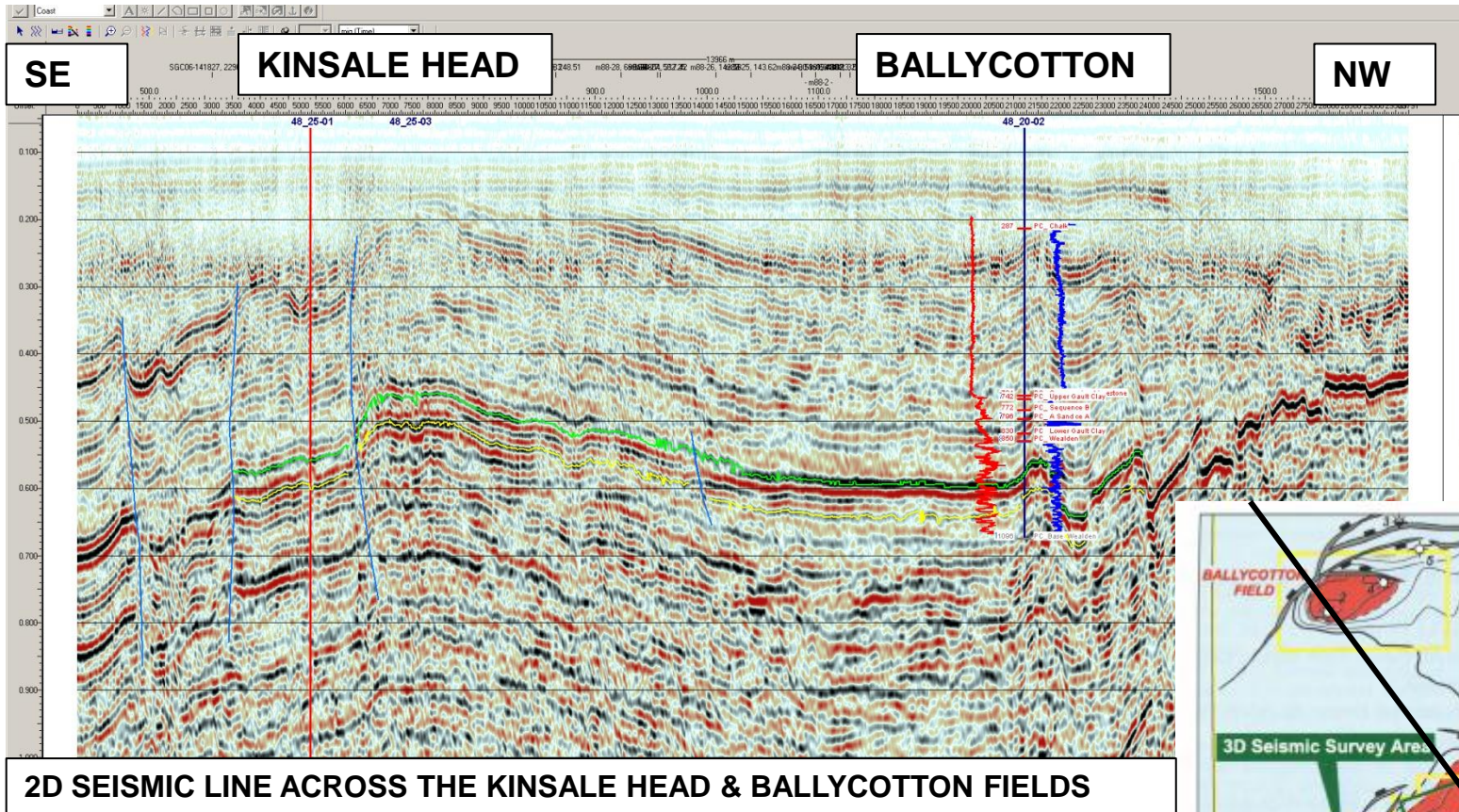


Dorset looking eastwards across Mupe Bay

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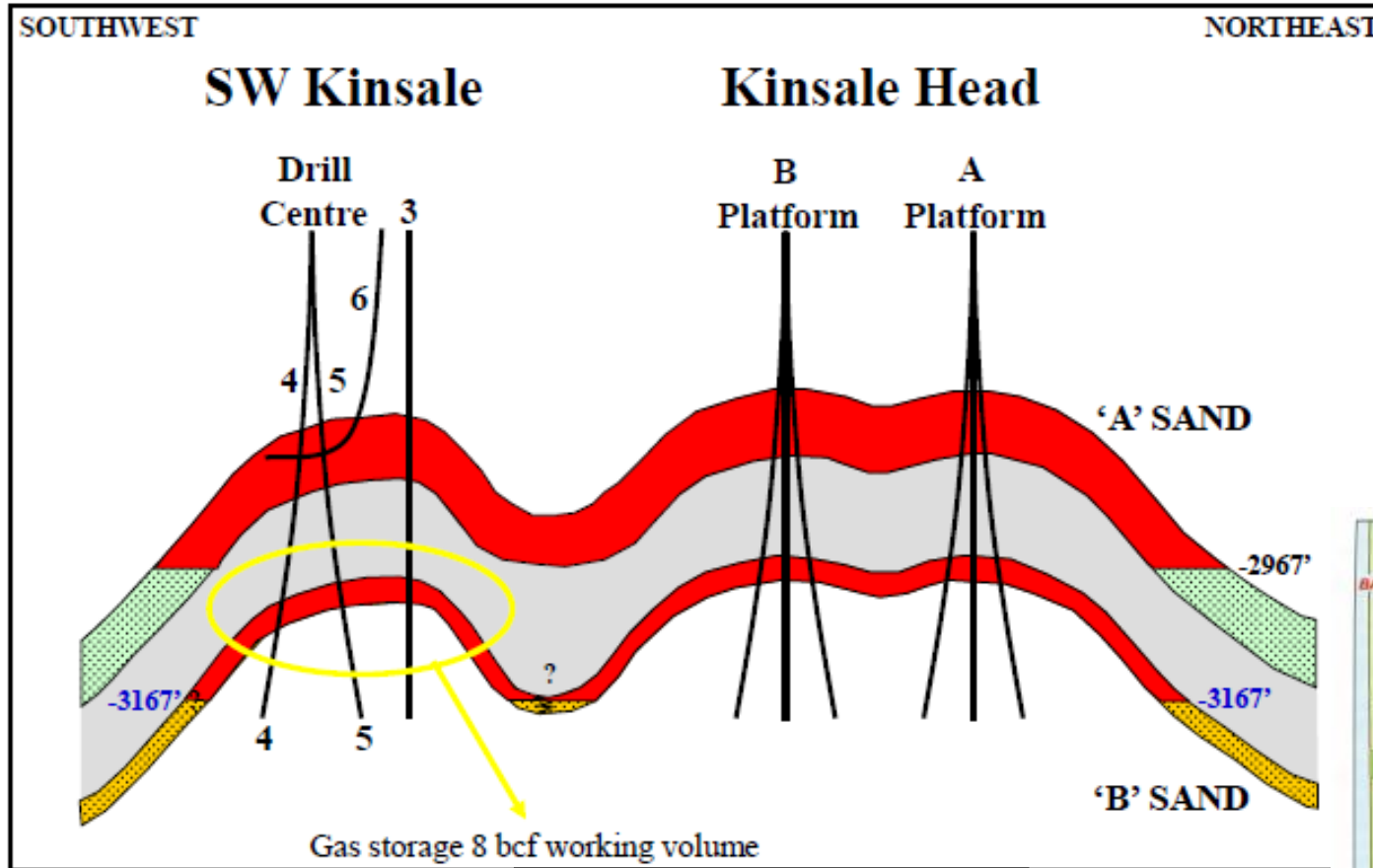


# Structures

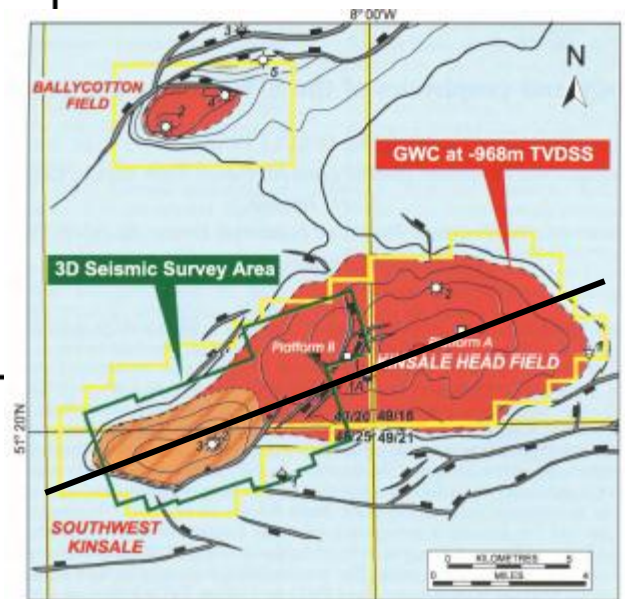


Source: O'Sullivan 2001

# Structures – Kinsale Head



Source: Kinsale Energy/PETRONAS



Source: O'Sullivan 2001

# Discoveries – in production

	Kinsale Head Gas Field (bcf)	Ballycotton Gas Field (bcf)	Seven Heads Gas Field (bcf)	Total
Original Gas in Place	1,900	60	40	2,000
Total Produced to end 2013	1,727	57	29	1,813
Future Gas Production	60	1	5	66
Total Gas Recoverable	1,787	58	34	1,879
Life of Field Gas Recovery	94%	97%	85%	

Source: Kinsale Energy/PETRONAS

# Discoveries – not in production

Discovery name	Discovery well	Year drilled	GIIP P90 (bcf)	GIIP P50 (bcf)	GIIP P10 (bcf)
Ardmore	49/14-1	1974	c.20	c.30	c.40
<b>Galley Head</b>	<b>48/18-1</b>	<b>1985</b>	<b>21</b>	<b>30</b>	<b>41</b>
Carrigaline	48/24-4	1990	60	82	108
Old Head	49/23-1	2006	49	57	64
Schull	57/2-3	2007	52	60	69
TOTAL GIIP			202	259	322
Recovery Factor %			65	75	85
Potential recoverable			131	194	274

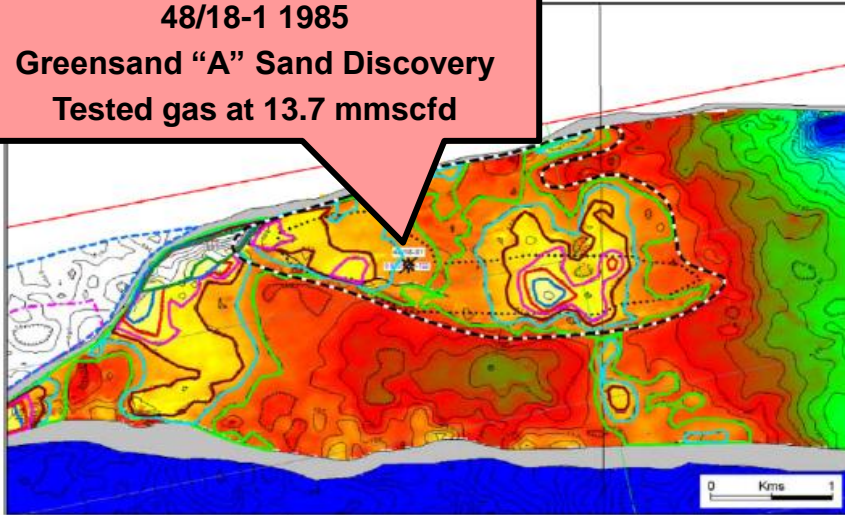
**In bold – covered by 3D Seismic**



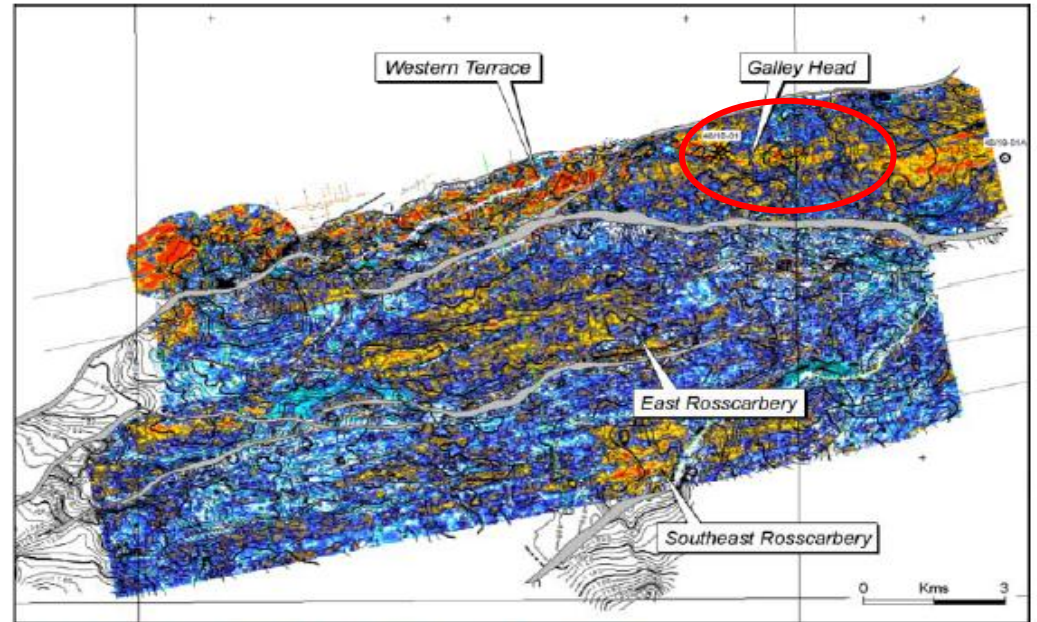
# Galley Head

48/18-1 1985

Greensand "A" Sand Discovery  
Tested gas at 13.7 mmscfd



Galley Head, 'A' Sand Volumetrics

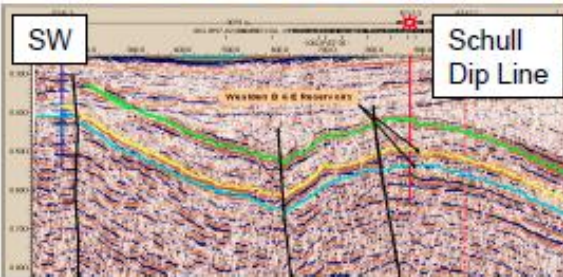
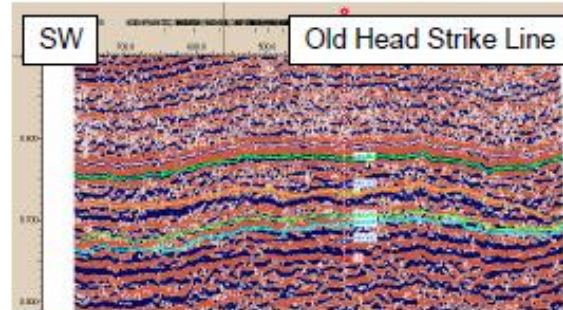
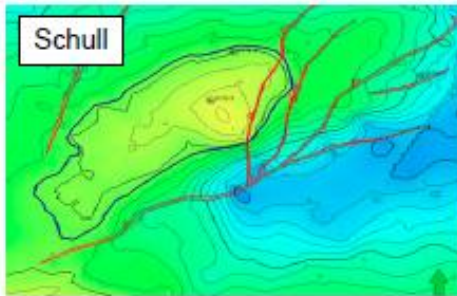
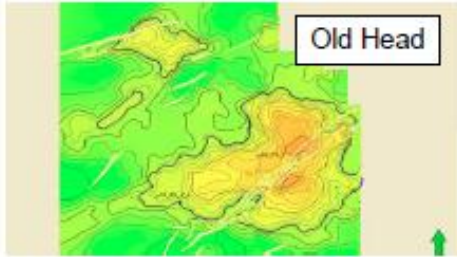


Top A Sand Amplitude Map – 'A' Sand Prospects

Water Depth :	295 feet
Planned Total Depth :	3,200 feet

Reservoir	BCF GIIP/Recoverable		
	P90	P50	P10
"A" Greensand	21/18	<b>30/25</b>	41/35
Total	21/18	<b>30/25</b>	41/35

# Old Head and Schull



**49/23-2z Tested gas at a rate of 18 mmscfd**

**57/2-3 Tested gas at a rate of 21 mmscfd**

# Why the Celtic Sea?

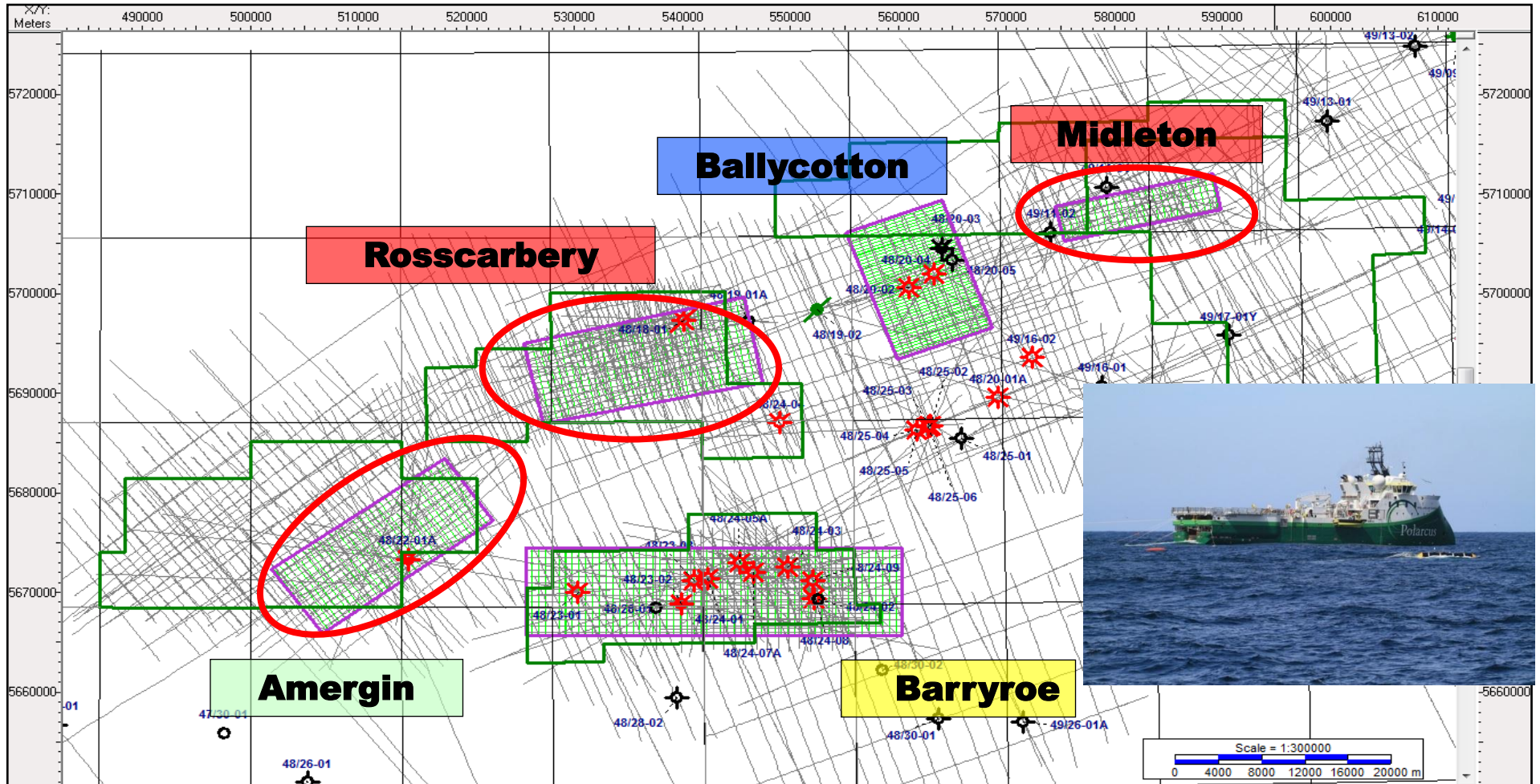
- Underexplored
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# Prospects

- Cretaceous Gas Prospects
  - Midleton
  - Rosscarbery
- Upper Jurassic/Lower Cretaceous Oil Prospects
  - Amergin

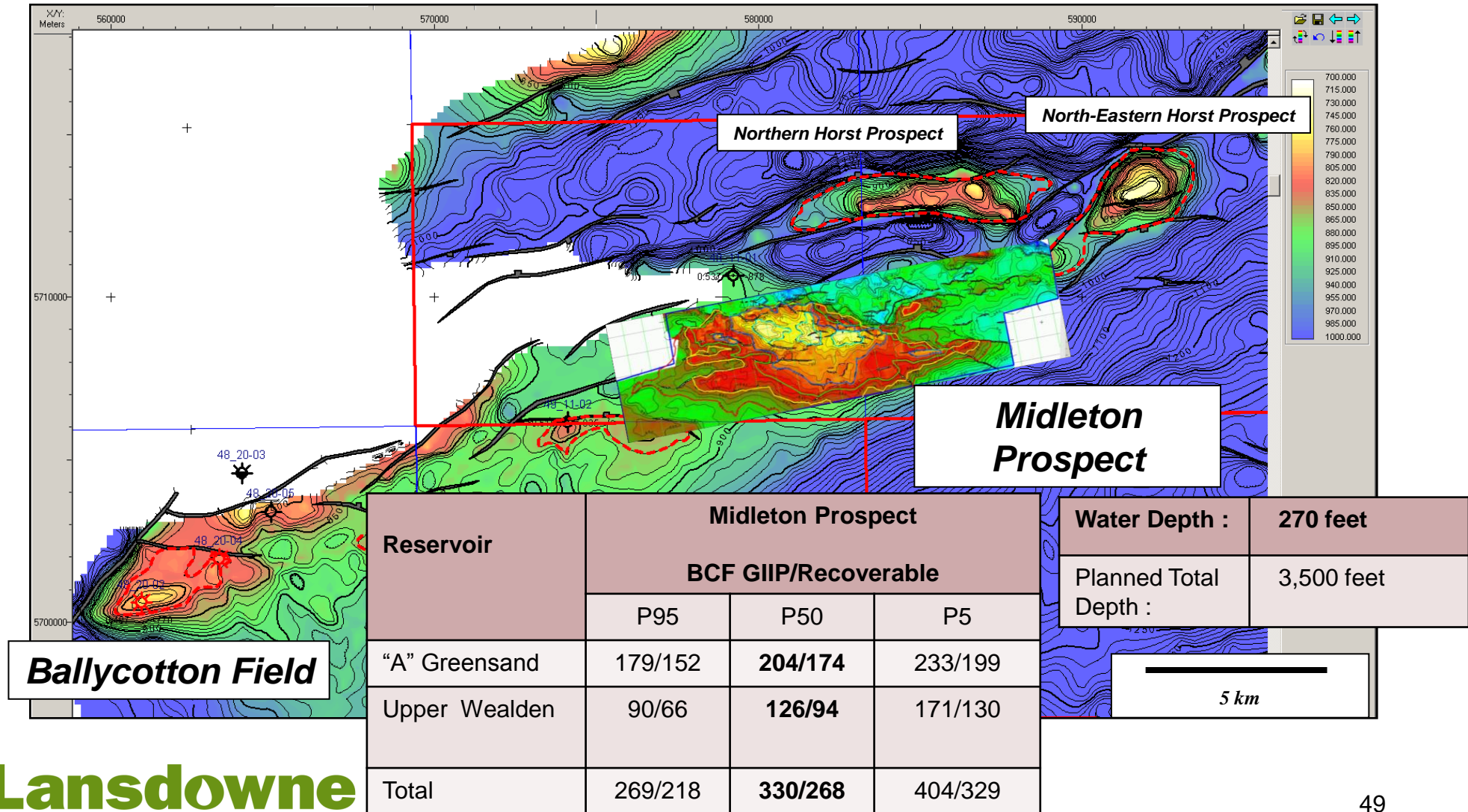
# Prospects - Benefits of 3D Seismic



# Cretaceous Gas Prospects

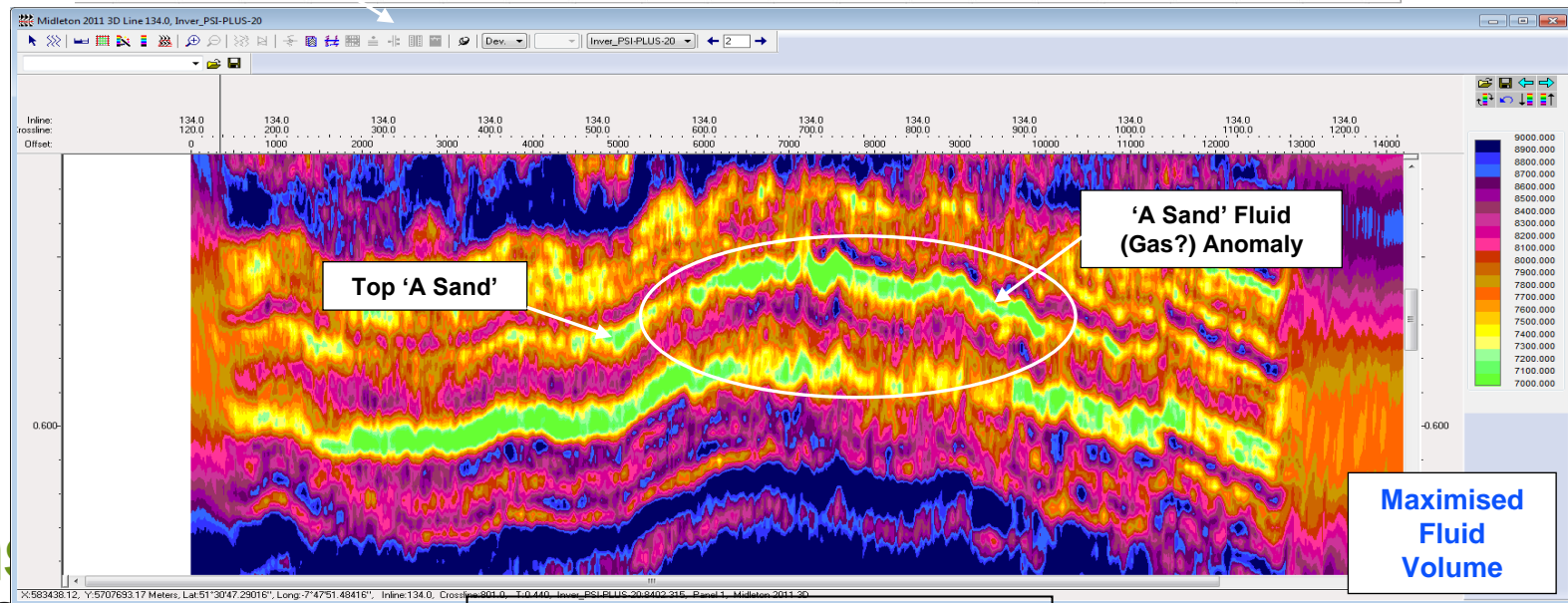
- Fluid substitution modelling work indicates that gas bearing sands in the Greensand and Wealden should generate a characteristic seismic response
- Fluid anomalies, interpreted as gas bearing Greensand reservoirs, identified in:
  - Galley Head gasfield
  - Middleton prospect
  - SE Rosscarbery prospect
- Fluid anomaly interpreted as possible gas bearing Upper Wealden sands identified in Main Rosscarbery prospect

# Midleton Prospect



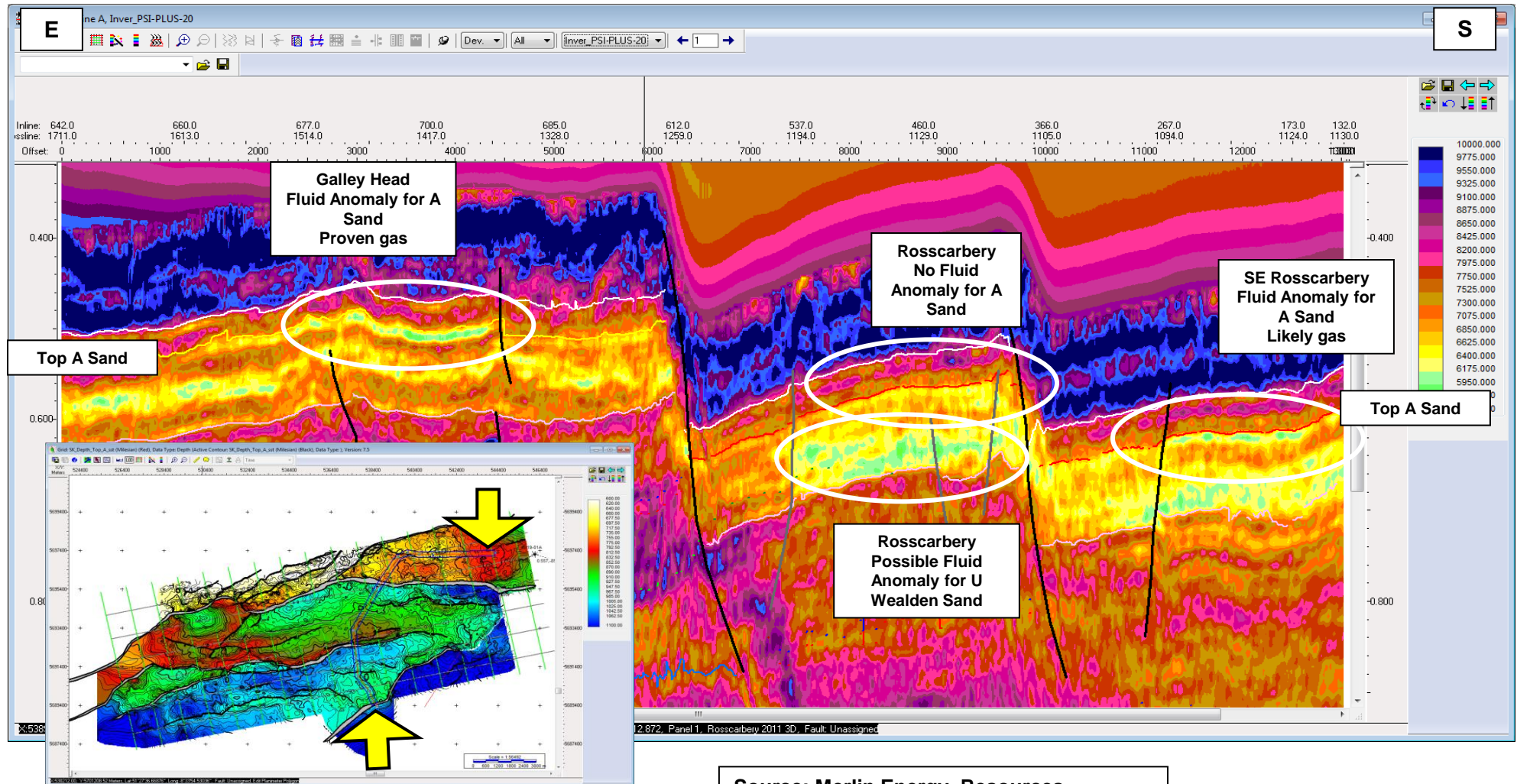


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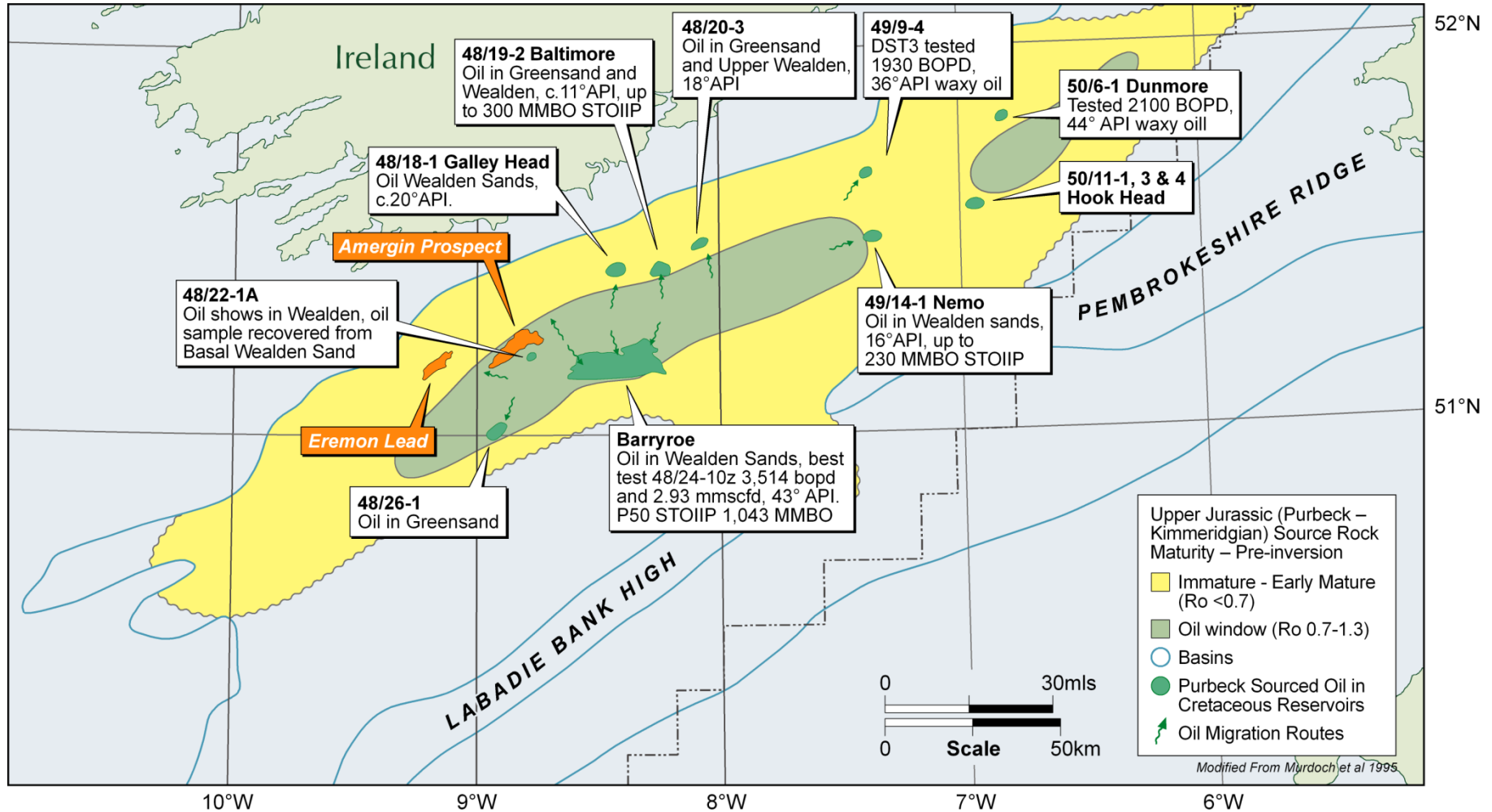


# Rosscarbery Prospect



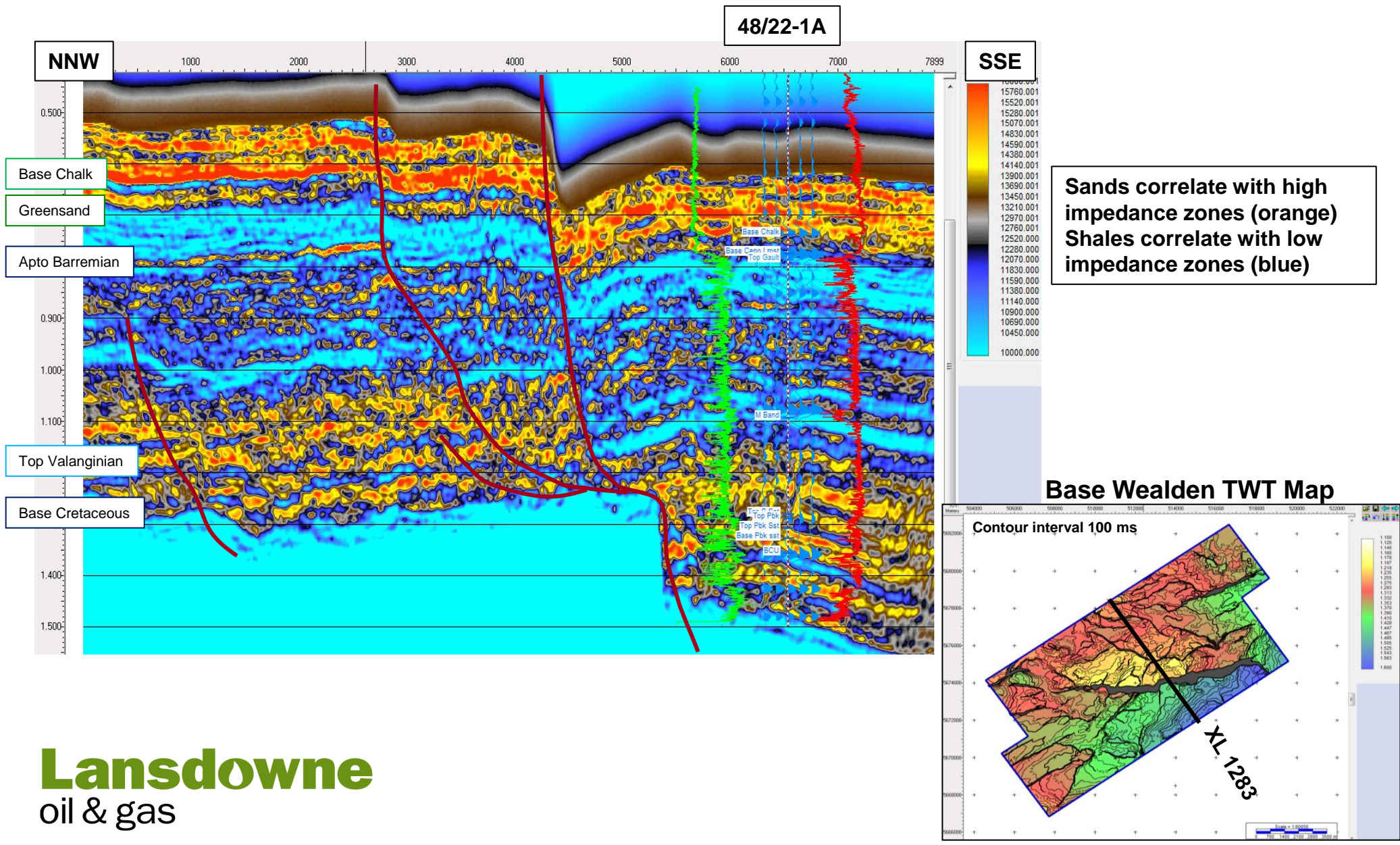
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# Amergin Prospect



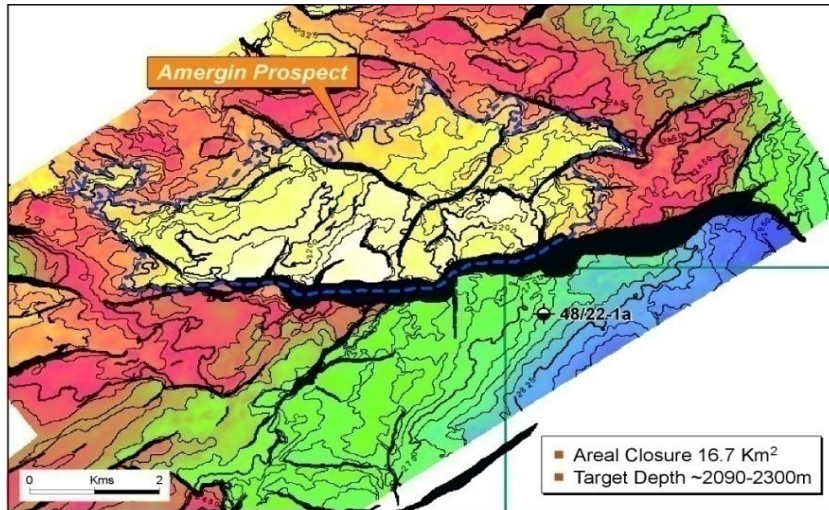


# Amergin Prospect – seismic inversion

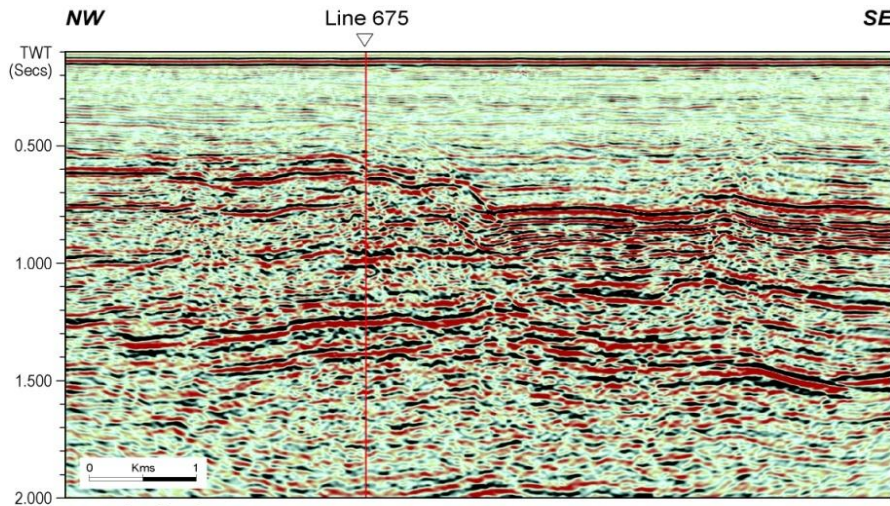




# Amergin Prospect



Base Lower Cretaceous "Wealden" Sandstone Structure Map.



3D Seismic Line 1110

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**Water Depth :**

**340 feet**

**Planned Total Depth :**

**11,000 feet**

Reservoir	MMbbl STOIIIP/Recoverable		
	P90	P50	P10
Hauterivian	87/23	<b>118/35</b>	154/50
Base Valanginian	126/31	<b>149/45</b>	177/60
Basal Wealden	297/73	<b>350/104</b>	409/139
Upper Jurassic	105/36	<b>122/47</b>	142/58
Total	615/163	<b>739/231</b>	894/307

Source: Merlin Energy Resources

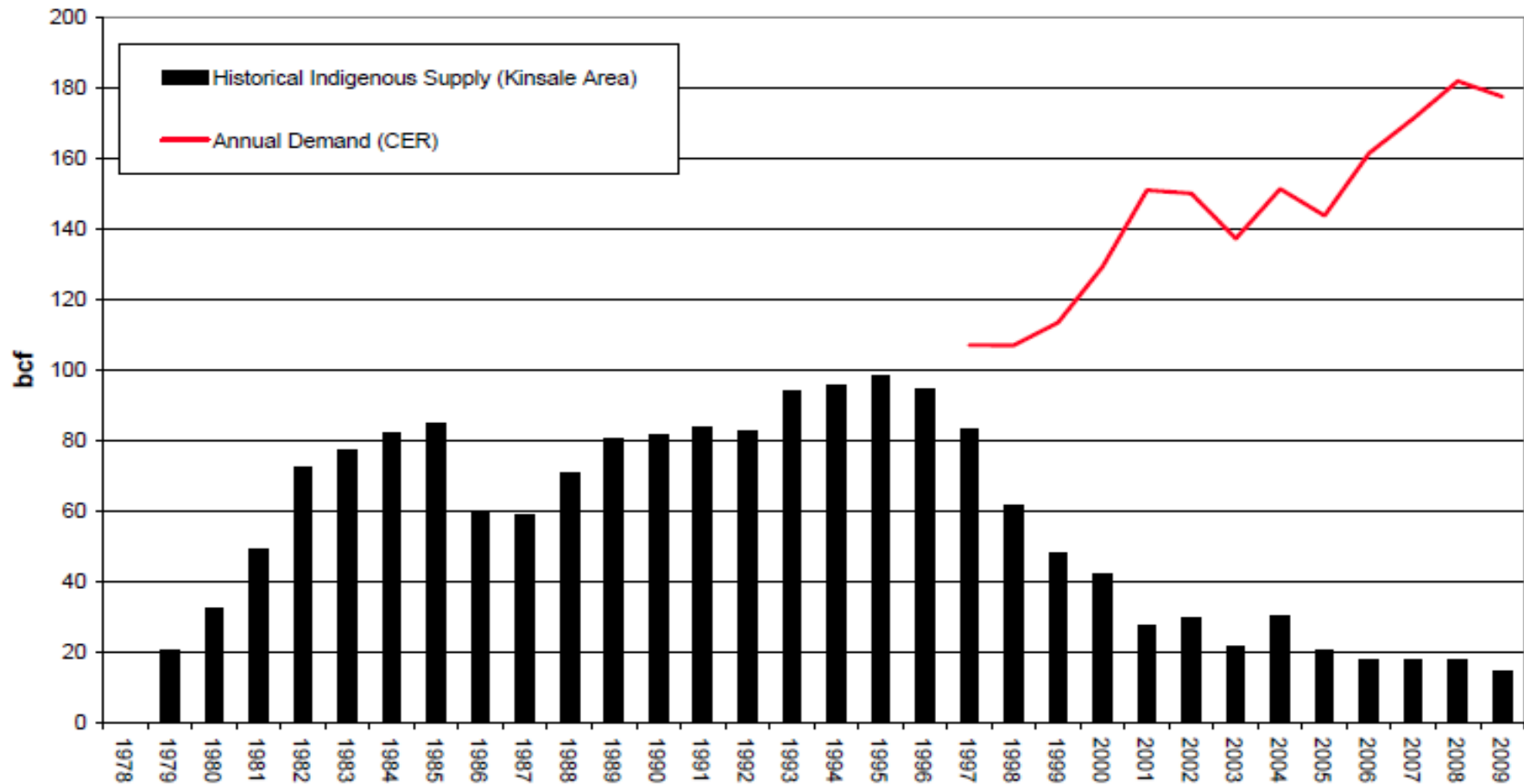


# Why the Celtic Sea?

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- Prospects
- **Infrastructure**

# Gas Market

Ireland's Annual Gas Demand and Indigenous Supply

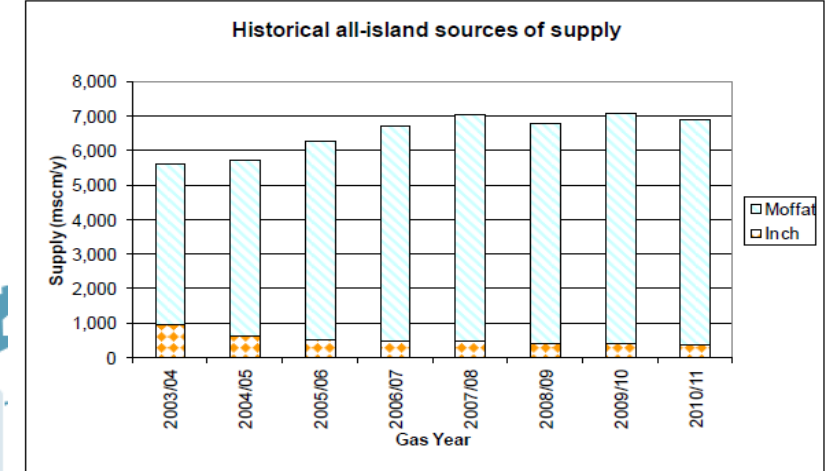


Source: DCENR

# Gas Market

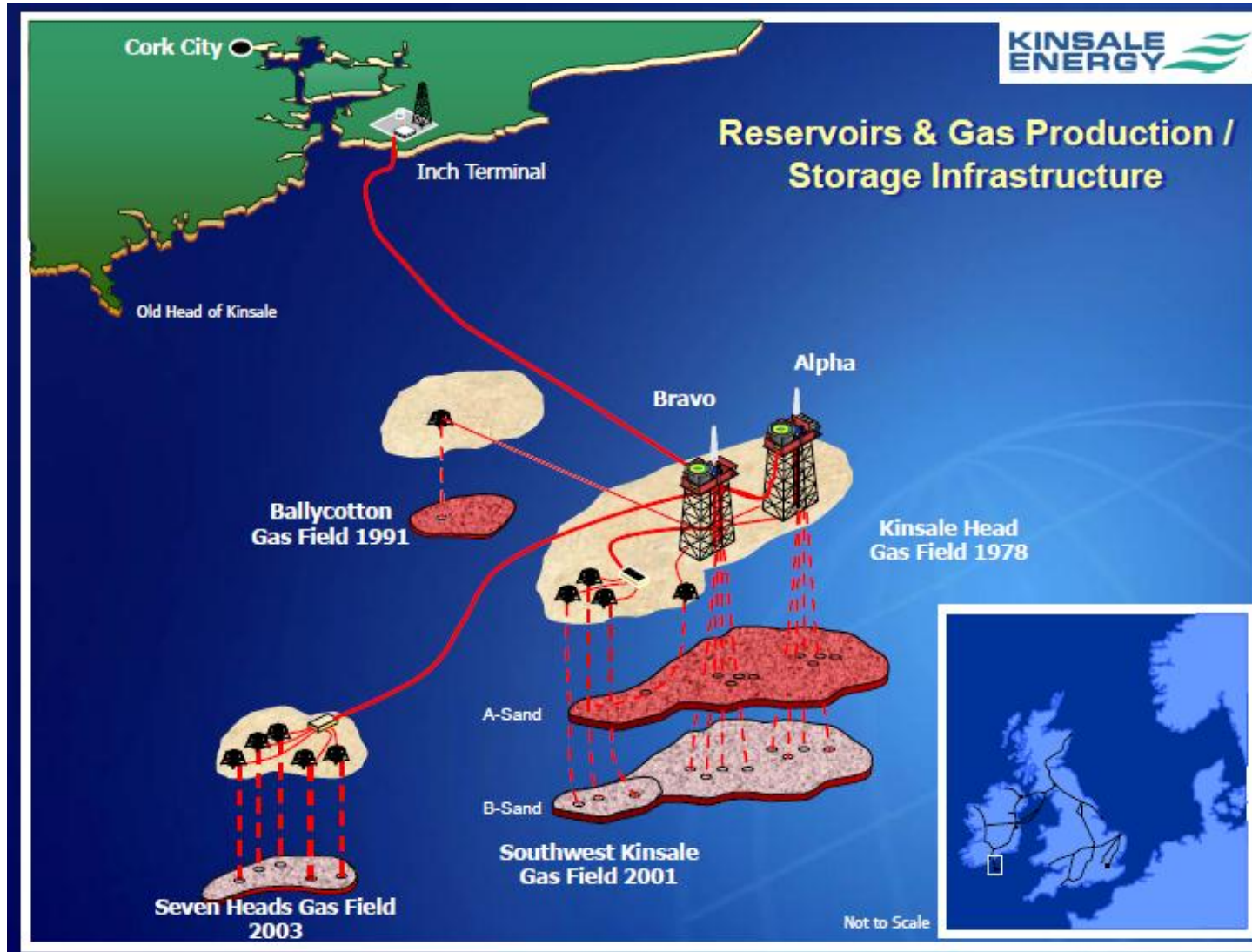


Figure 4-2: Historical All-island Sources of Supply



- **Winter Outlook 2013/2014**
  - Gas supplies from Great Britain via Moffat will continue to meet over 93% of demand
  - Corrib Gas not expected to commence until 2015

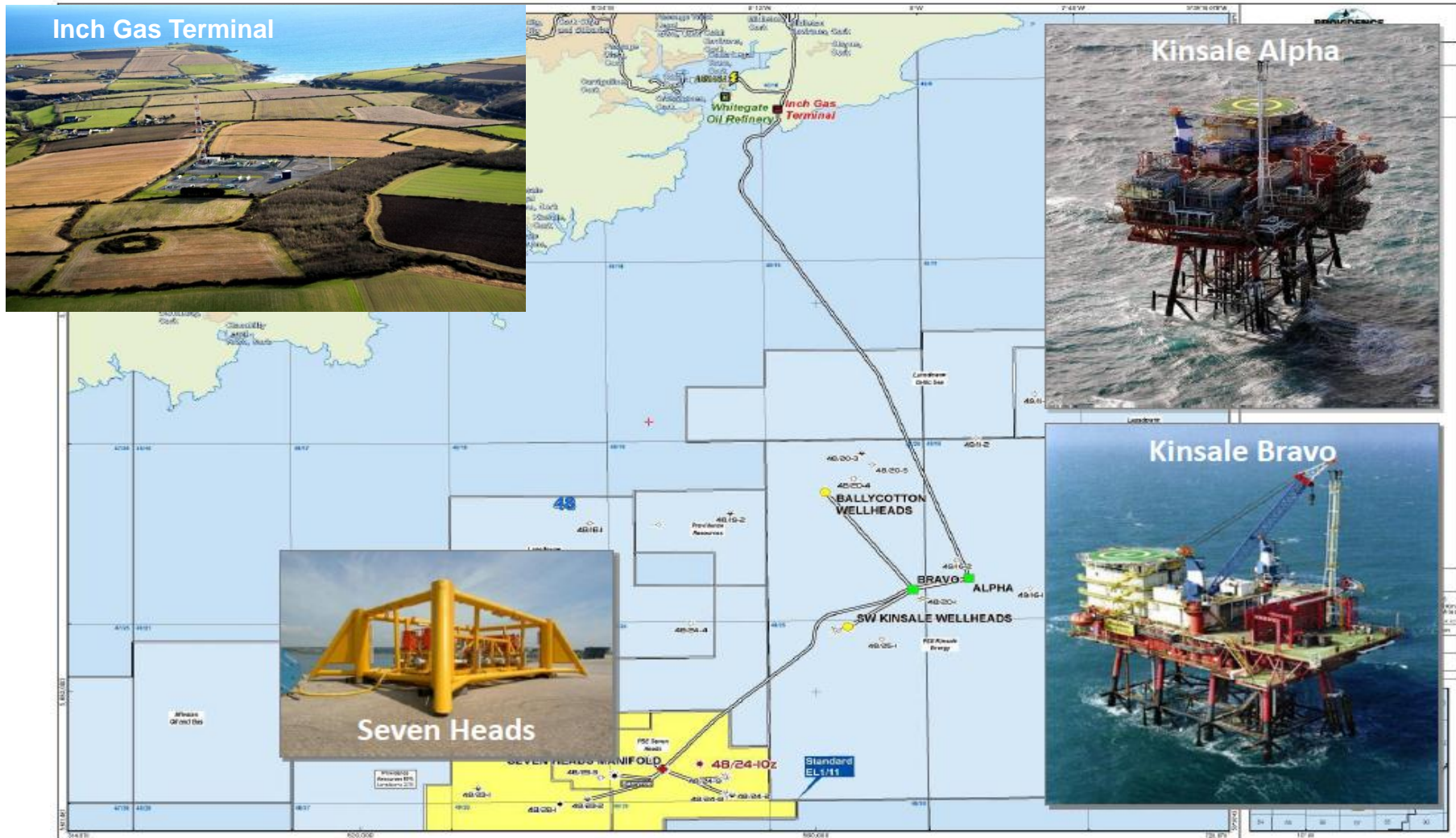
# Development Concepts



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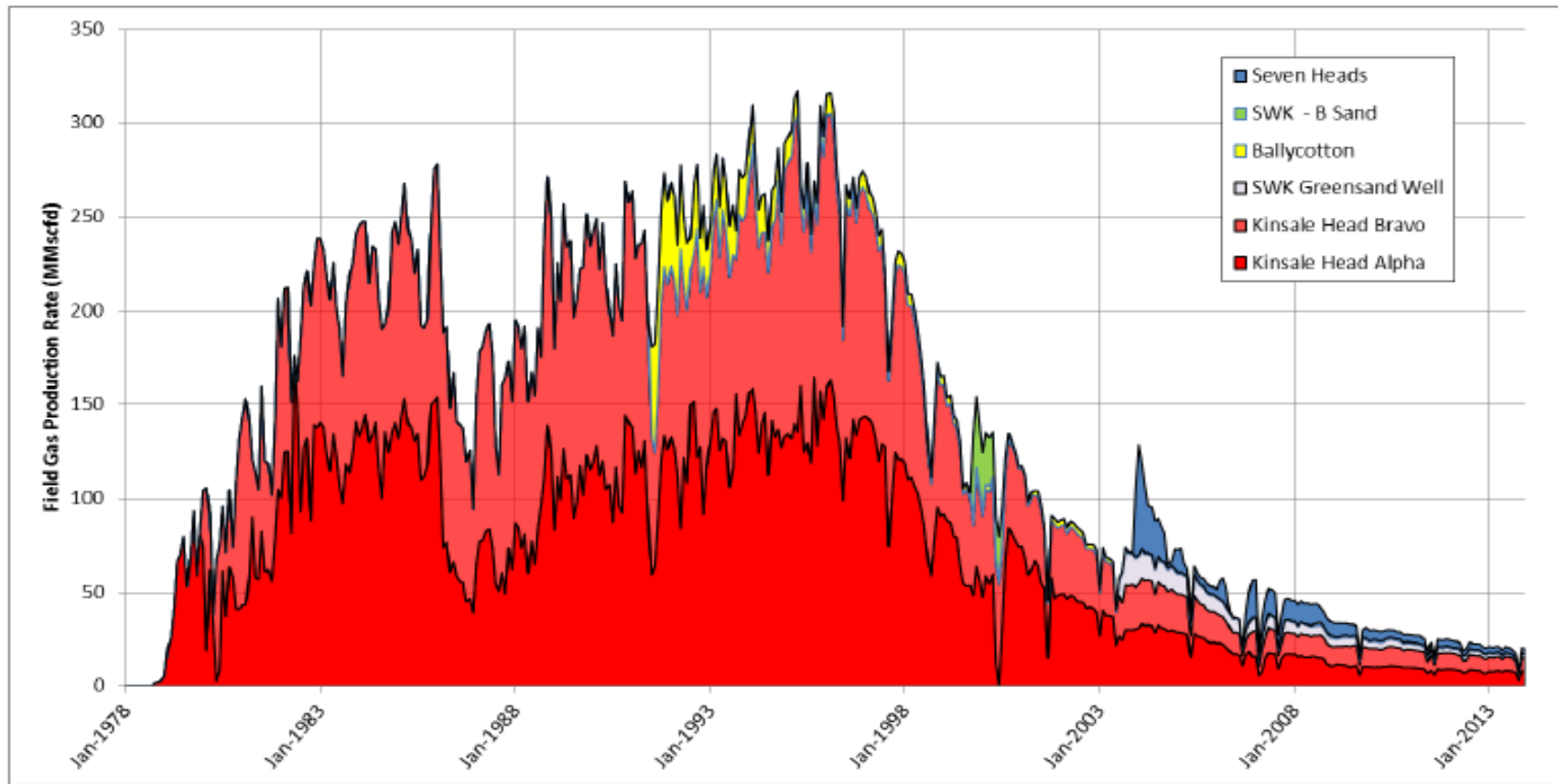
# Infrastructure



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Sources: PSE Kinsale Energy/PETRONAS & Providence Resources

# Kinsale Area Production History



Source: Kinsale Energy/PETRONAS

# Kinsale Area Production Capability

## ● Infrastructure Capability

- Kinsale Infrastructure limited to gas processing & transportation
- Existing gas processing capacity c. 200 mmscfd
- Existing Utilisation c. 50%
- Additional Processing Capacity can be added
- Export Pipeline Capacity c. 300 mmscfd

## ● Infrastructure Longevity

- Existing Production/Storage Life 5 to 7 years
- The Infrastructure has been well maintained and the process fluids are benign
- Although original design life was 25 years, jacket, topsides and pipeline inspection as well as integrity analyses indicate that a life in excess of 50 years could be achievable

# Conclusions

- Underexplored
  - Proven Petroleum Systems
  - Prospects
  - Infrastructure
- 
- All the ingredients for success



# Celtic Sea



**Thank you**