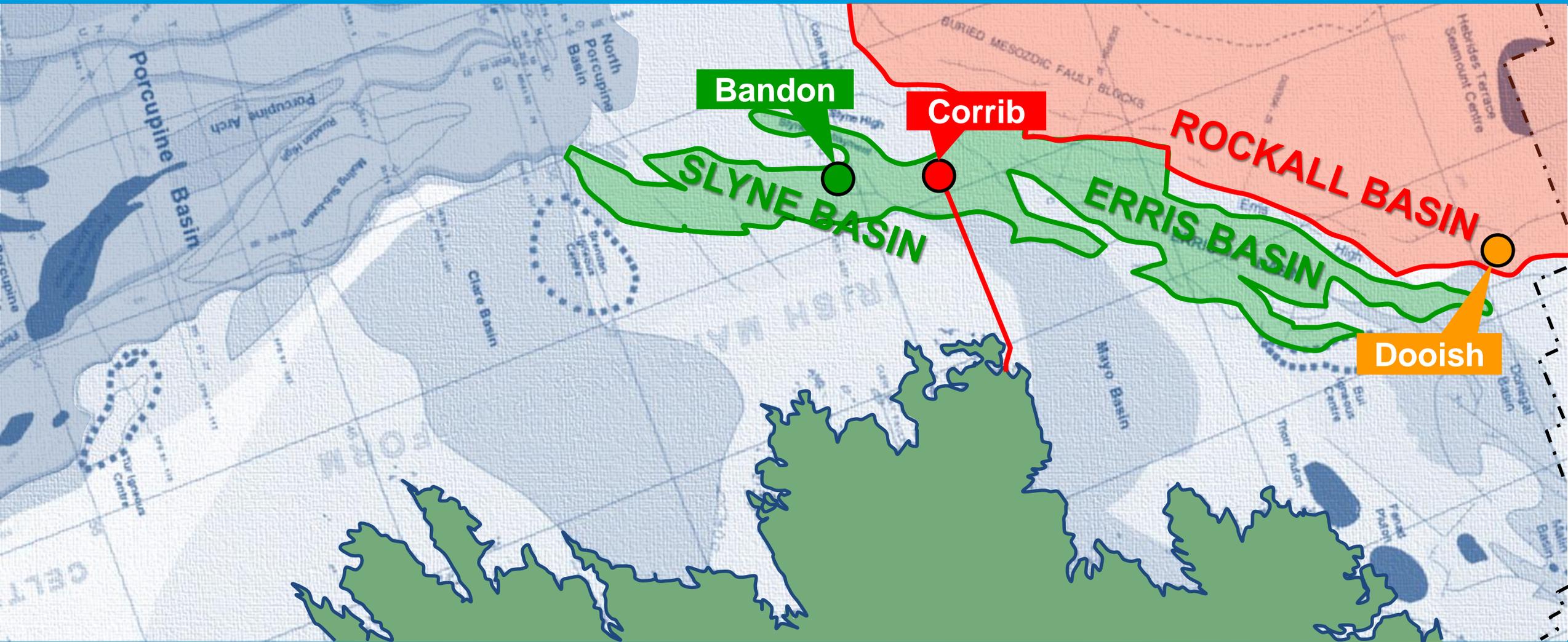


Key Elements of the Petroleum Systems of the Rockall and Slyne-Erris Basins



Rockall and Slyne-Erris Basins

- Only 11 exploration wells drilled to date
- Three proven hydrocarbon systems
 - **Dooish Discovery**
 - Upper Jurassic sourced gas-condensate in Middle Jurassic & Permian sst reservoirs
 - **Corrib Field**
 - Carboniferous sourced gas in Triassic sandstone reservoir
 - **Bandon Discovery**
 - Lower Jurassic sourced oil in Lower Jurassic sandstone reservoir
- **Proven reservoirs**
 - Cretaceous, Middle Jurassic, Lower Jurassic, Triassic, Permian & Carboniferous
- **Proven source rocks**
 - Lower Jurassic, Upper Jurassic & Carboniferous

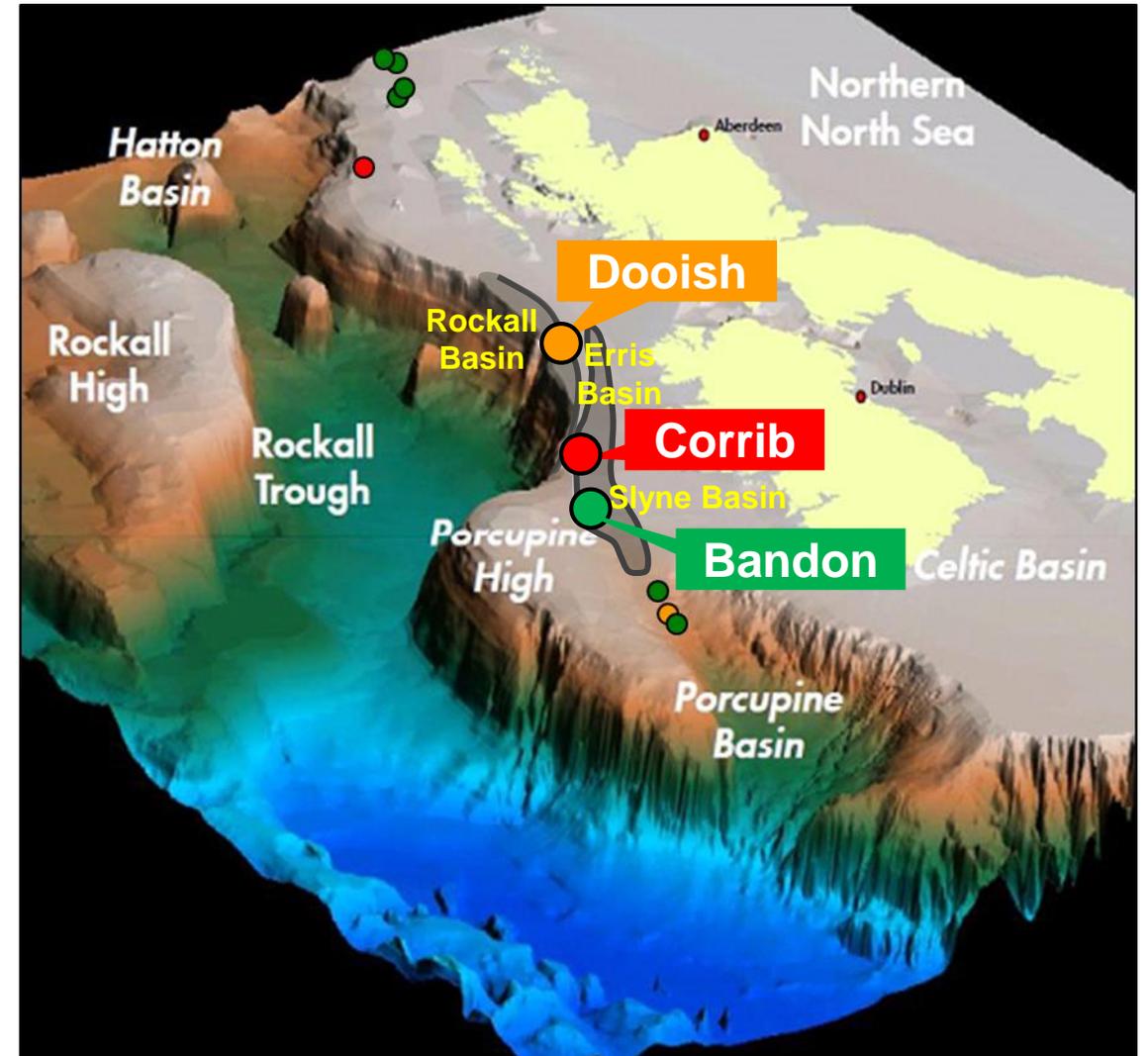


Image adapted from Onyeagoro et al, PESGB Lecture Abstract 2015

North Atlantic Petroleum Systems Context

- Irish Atlantic shares geology with Newfoundland, UK, Faroe & Norwegian Atlantic margins
- Numerous rifted basins and more than one proven play
- Slyne-Erris and Rockall Basins are located in the centre of this trend
- Slyne-Erris and Rockall Basins contain one field and two discoveries, representing three hydrocarbon systems
 - Dooish (gas-condensate)
 - Corrib (gas)
 - Bandon (oil)

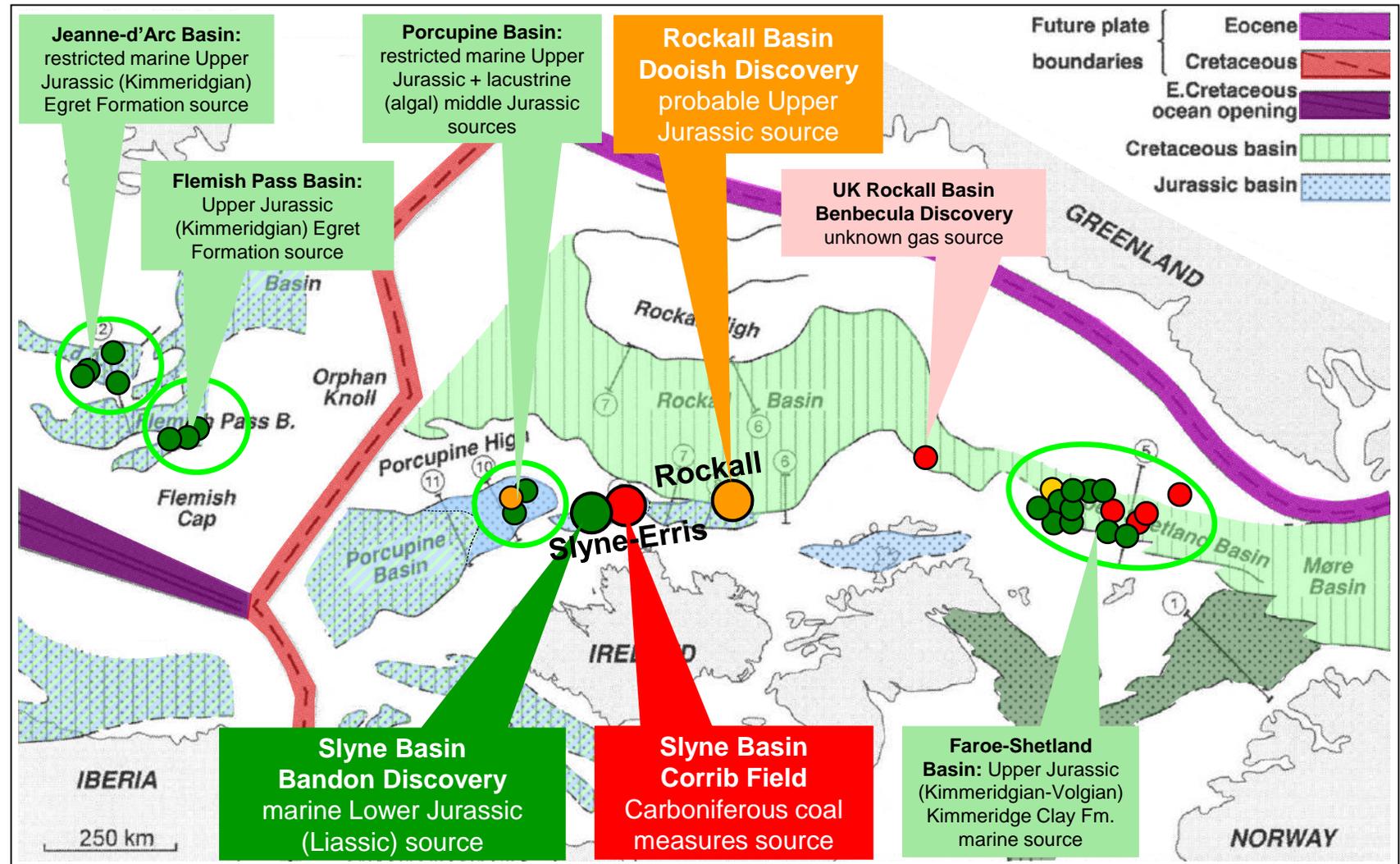
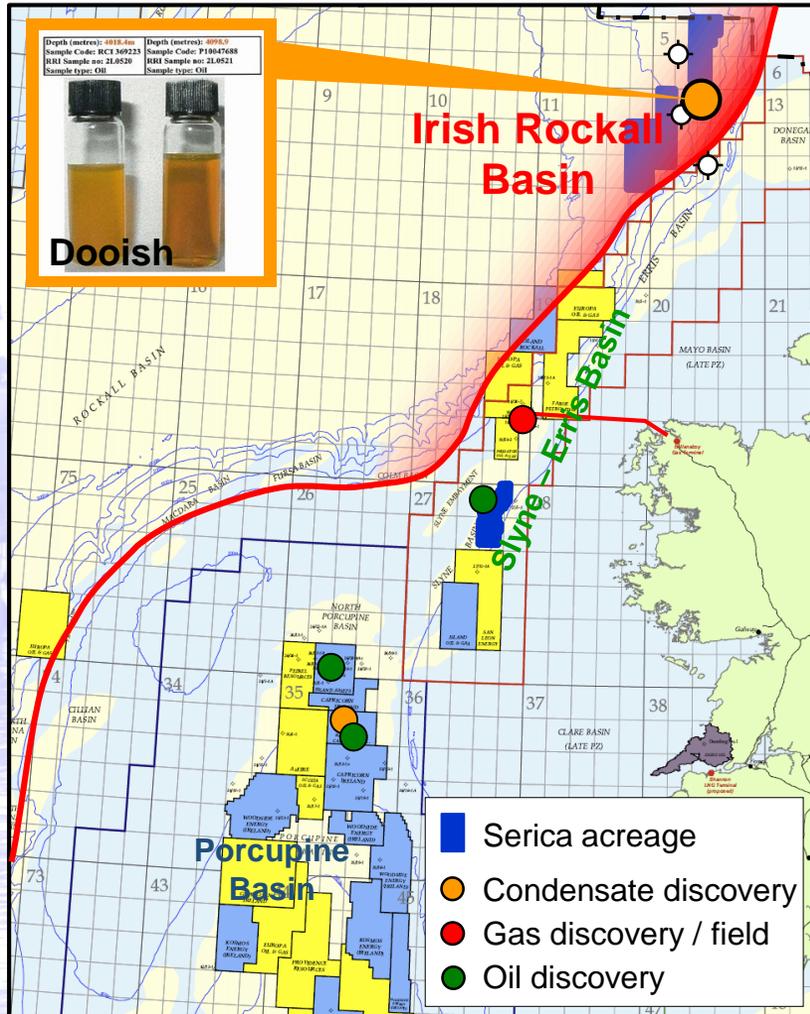


Plate Reconstruction at Barremian, 130 Ma

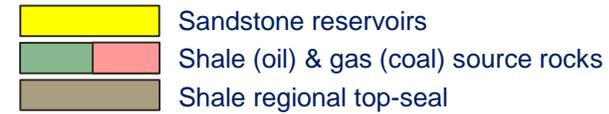
(After Spencer & MacTiernan, 2001)

Rockall Basin: The Key Play Elements

Location Map

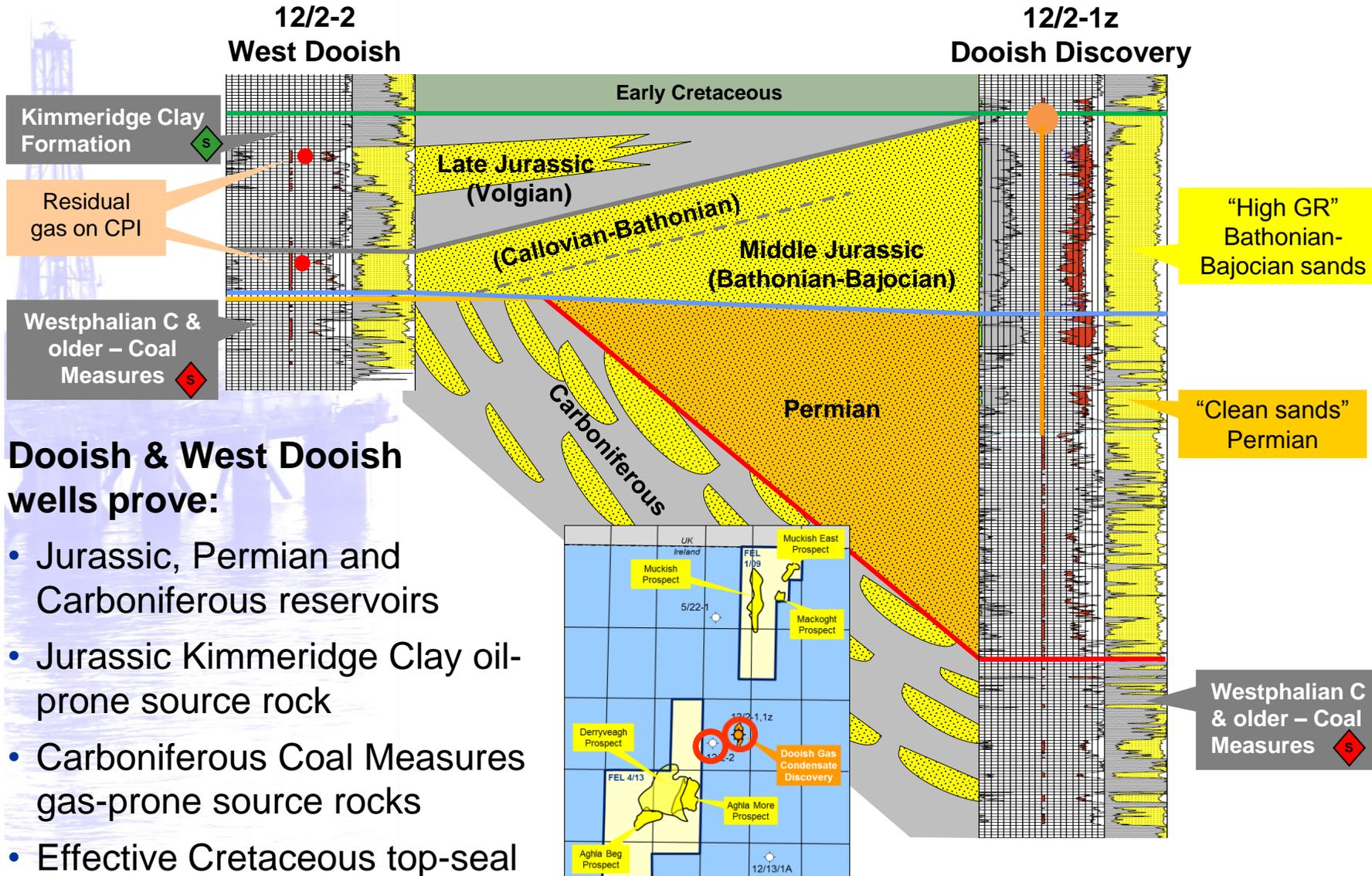


Map from PAD (2016)



Stratigraphy	RESERVOIR	SOURCE	SEAL
EOCENE	possible		proven
PALAEOCENE	Volcanics, particularly to the west		
UPPER CRETACEOUS			proven
LOWER CRETACEOUS	likely	possible	proven
UPPER JURASSIC	proven	proven	proven
MIDDLE JURASSIC	proven	possible	
LOWER JURASSIC		possible	possible
TRIASSIC	proven		
PERMIAN	proven		
CARBONIFEROUS	proven	proven	

Rockall Basin: Dooish Discovery

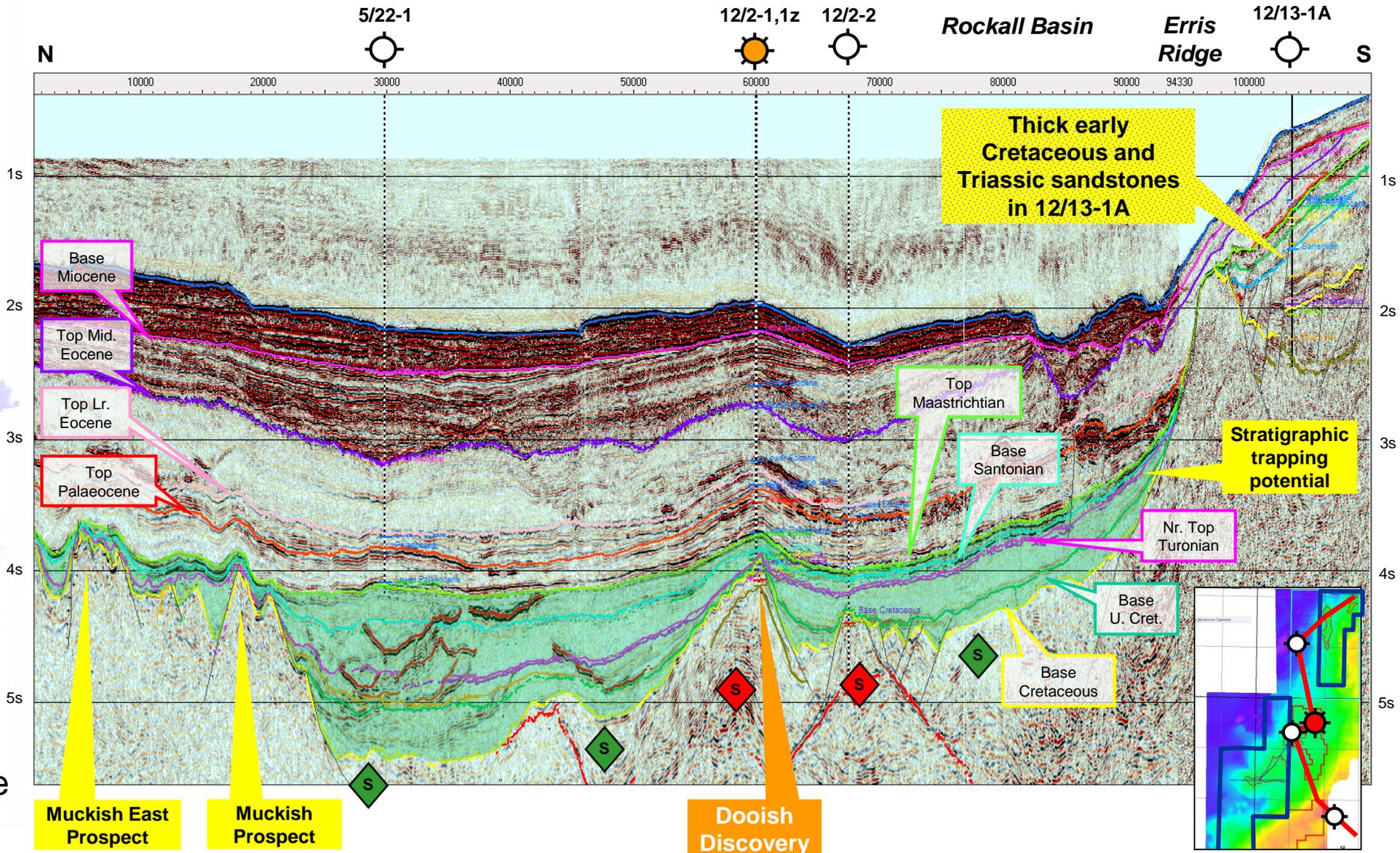


Dooish Discovery

- Structural trap below Base Cretaceous
- High N/G Middle Jurassic and Permian reservoir, average Ø 14%
- 214m 45 °API gas condensate column
- Geochemical analysis suggested **mixed** terrestrial/marine source rock at peak maturity
- Core analysis suggests early oil charge flushed by later wet gas charge
- Upper Jurassic oil-prone source? - With possible Carboniferous component

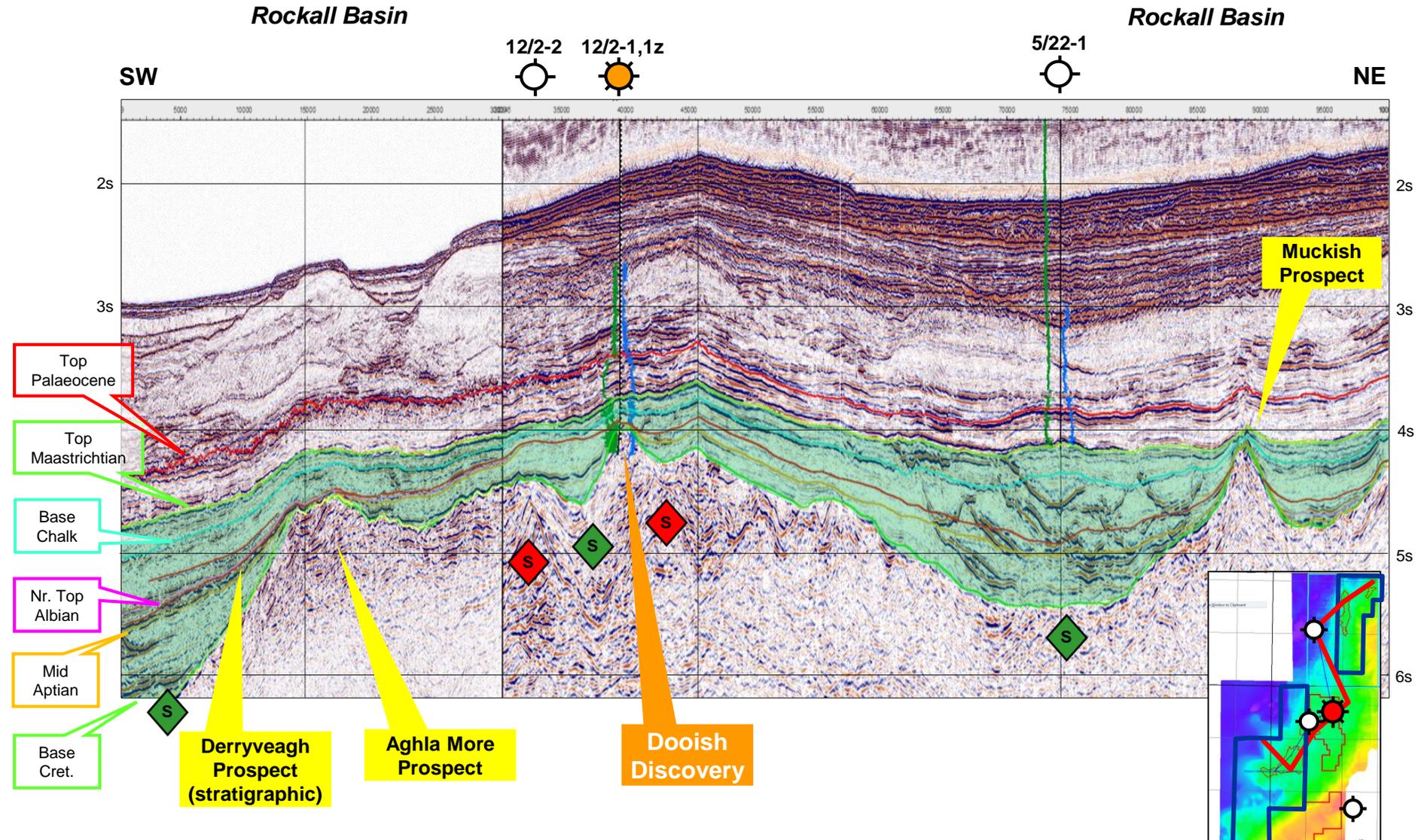
Rockall Basin: Regional Seismic Line (1)

- Structural traps below Base Cretaceous including Dooish Discovery, Muckish & Muckish East Prospects
- Re-mobilisation of sands across Erris Ridge and re-deposition as turbidite fans during Aptian-Albian – stratigraphic targets
- Upper Jurassic source kitchens in half-grabens below Base Cretaceous
- Carboniferous source rocks within pre-rift



Rockall Basin: Regional Seismic Line (2)

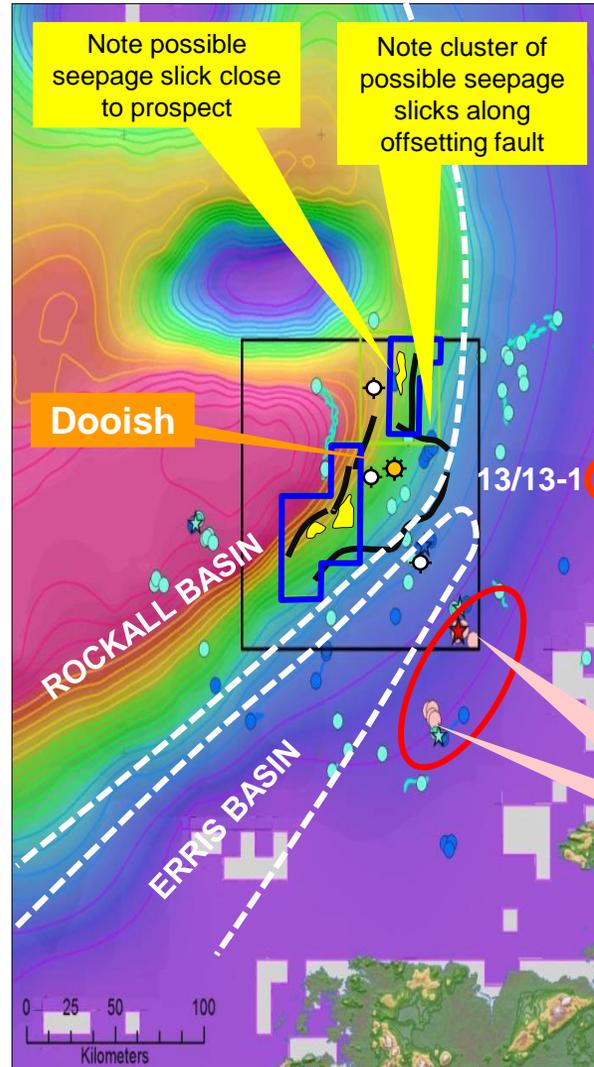
- Structural traps below Base Cretaceous including Dooish Discovery, Muckish and Aghla More Prospects
- Turbidite fans of Aptian-Albian including the Derryveagh Prospect
- UK West of Shetlands and Atlantic West Africa stratigraphic trapping analogues



Rockall Basin: Potential Carboniferous Source

- Geographic distribution of slicks, (satellite mapping) suggests more than one working hydrocarbon system
- No thick Jurassic basins to SE of Erris Basin; therefore, slicks in this area probably have a Palaeozoic origin
- Dooish 12/2-1 and West Dooish 12/2-2 tagged the top of the Carboniferous
- 13/13-1 (nearby Donegal Basin) penetrated 800m of classic Carboniferous Coal Measures
- Dooish gas-condensate may have both a Carboniferous oil and gas component?

Slick Mapping Study 2014 (CGG's Satellite Mapping Group)



Note possible seepage slick close to prospect

Note cluster of possible seepage slicks along offsetting fault

Dooish

Slick Centre Points

- Seepage Slick Third Rank
- Priority Unassigned Slick
- Unassigned Slick

Slick Outlines

- Seepage Slick Third Rank
- Priority Unassigned Slick
- Unassigned Slick

Cluster Centres

Score Percent

- 81 - 90
- 71 - 80
- 61 - 70
- 50 - 60

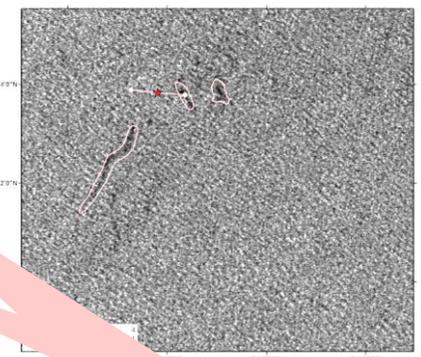
Sediment Thickness

Value

- High
- Low

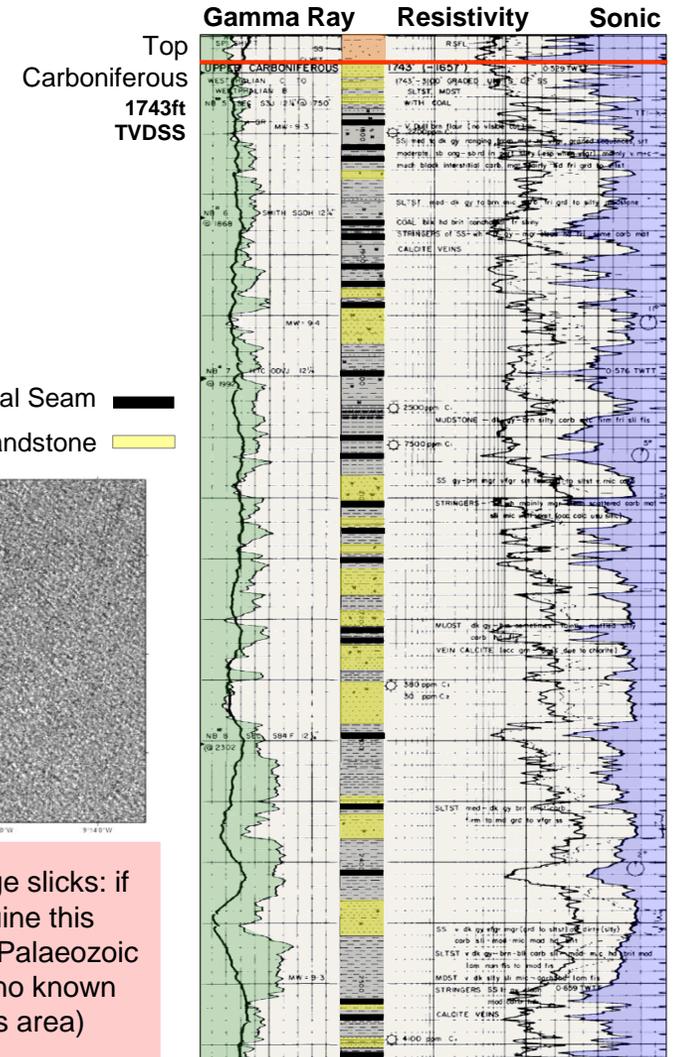
Coal Seam

Sandstone



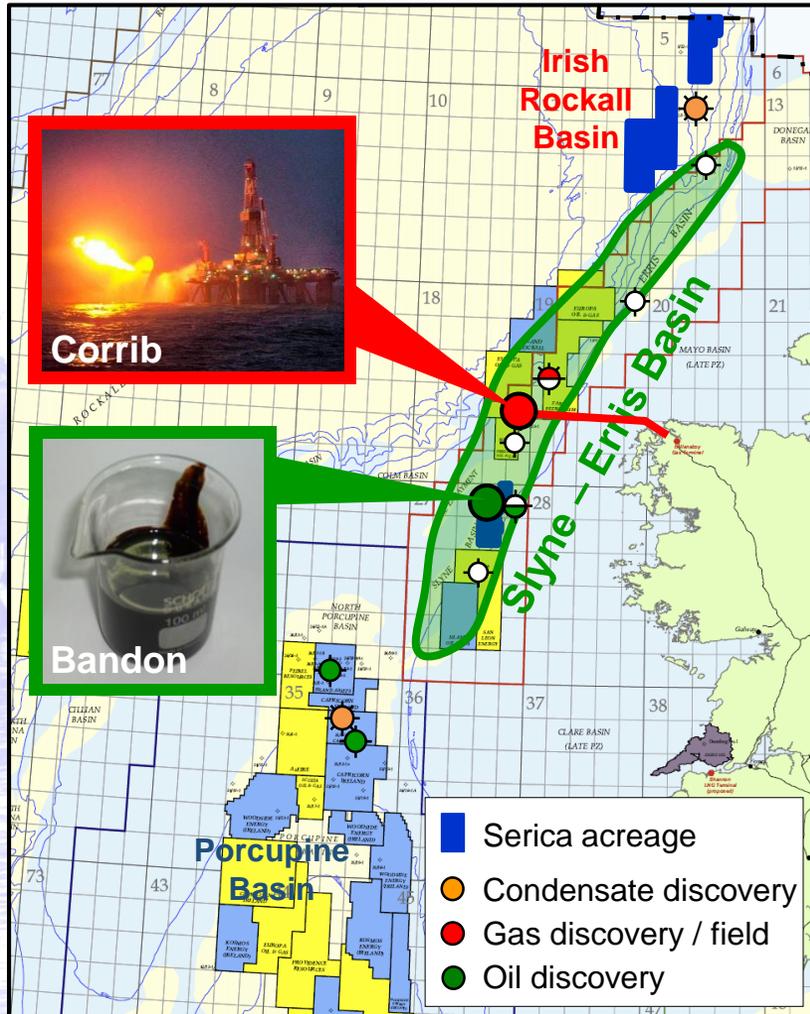
Repeated seepage slicks: if these are genuine this implies a working Palaeozoic source kitchen (no known Jurassic in this area)

13/13-1 Well (Carboniferous top 250m)



Slyne - Erris Basins: The Key Play Elements

Location Map



Map from PAD (2016)

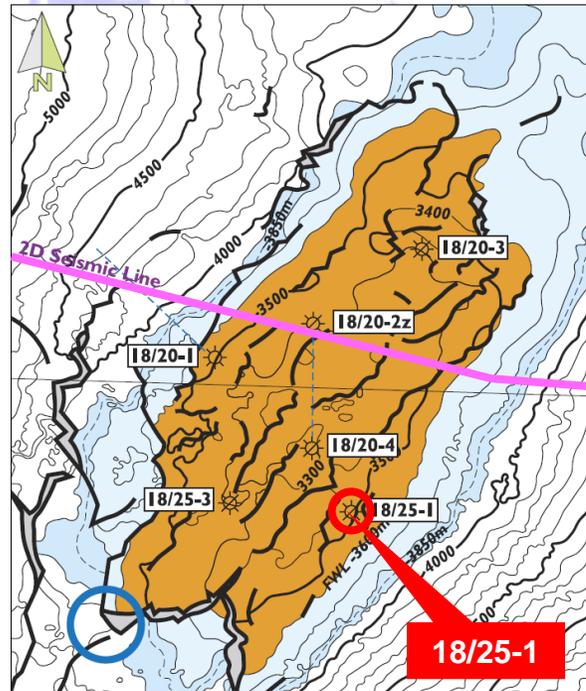
- Sandstone reservoirs
- Shale (oil) & gas (coal) source rocks
- Shale or salt regional top-seal

Stratigraphy	RESERVOIR	SOURCE	SEAL
EOCENE			
PALAEOCENE	Volcanics in North Slyne & Erris basins		
UPPER CRETACEOUS	Thick chalk (where not eroded)		
LOWER CRETACEOUS	Typically absent or highly condensed		
UPPER JURASSIC			possible
MIDDLE JURASSIC	proven	possible	proven
LOWER JURASSIC	proven	proven	proven
TRIASSIC	proven		Proven
PERMIAN	possible		Proven
CARBONIFEROUS	possible	proven	

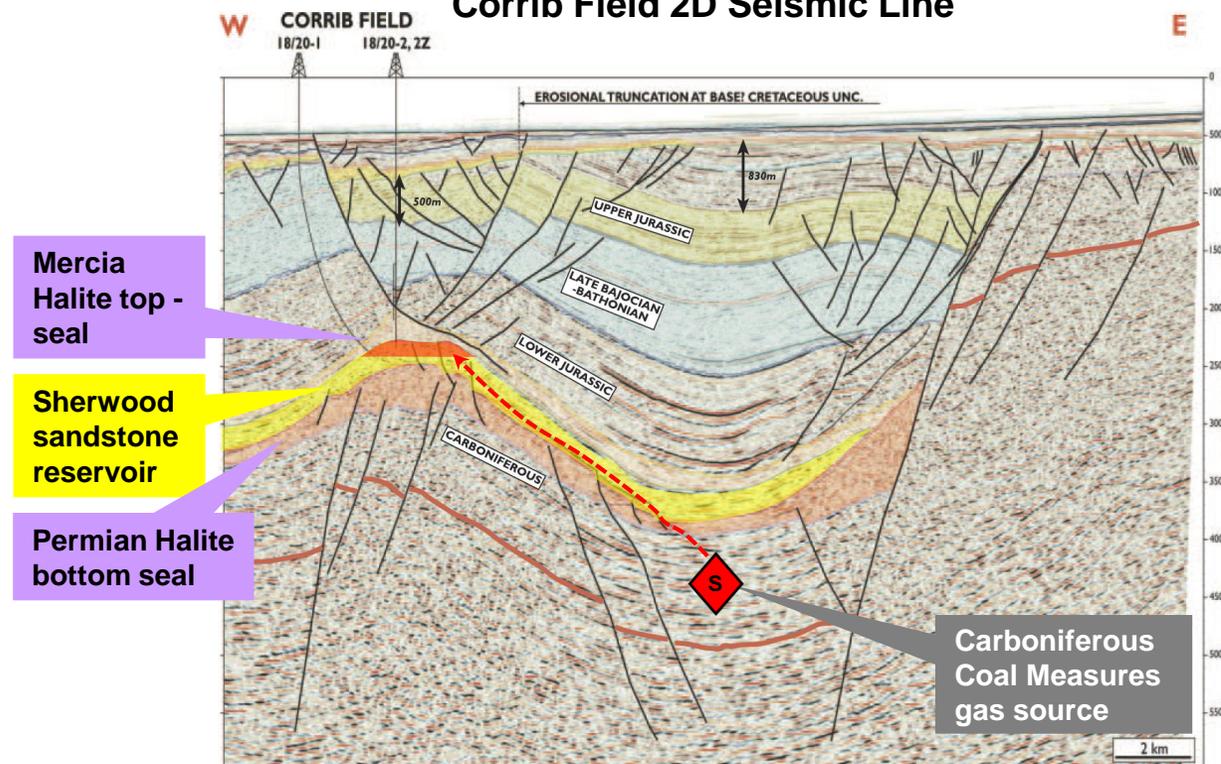
Slyne Basin: Corrib Field

- Complex faulted roll-over anticline with Triassic Sherwood Sandstone reservoir and Mercia Halite top-seal
- Subsurface interpretation initially hampered by poor-quality seismic data
- 1 tcf dry gas in place, sourced from Carboniferous Coal Measures
- Thick, high-quality reservoir capable of strong delivery rates; e.g. 18/25-1 64mmscfd

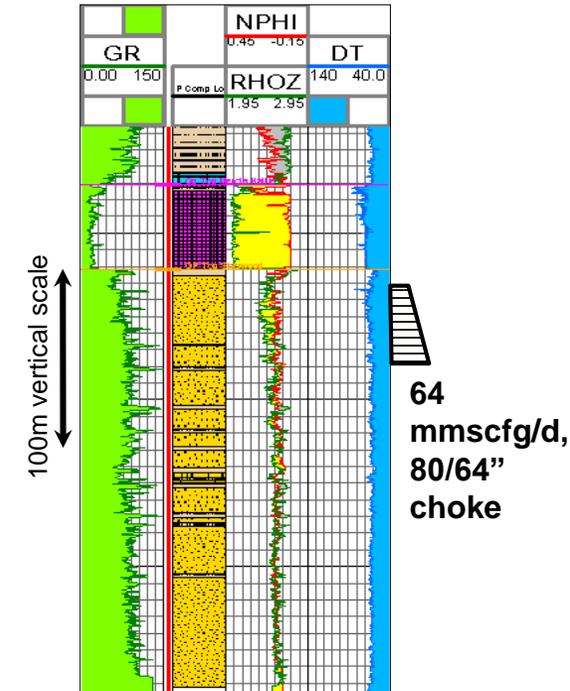
Corrib Field Top Sherwood Sandstone Reservoir Depth Map



Corrib Field 2D Seismic Line



Corrib 18/25-1 Well

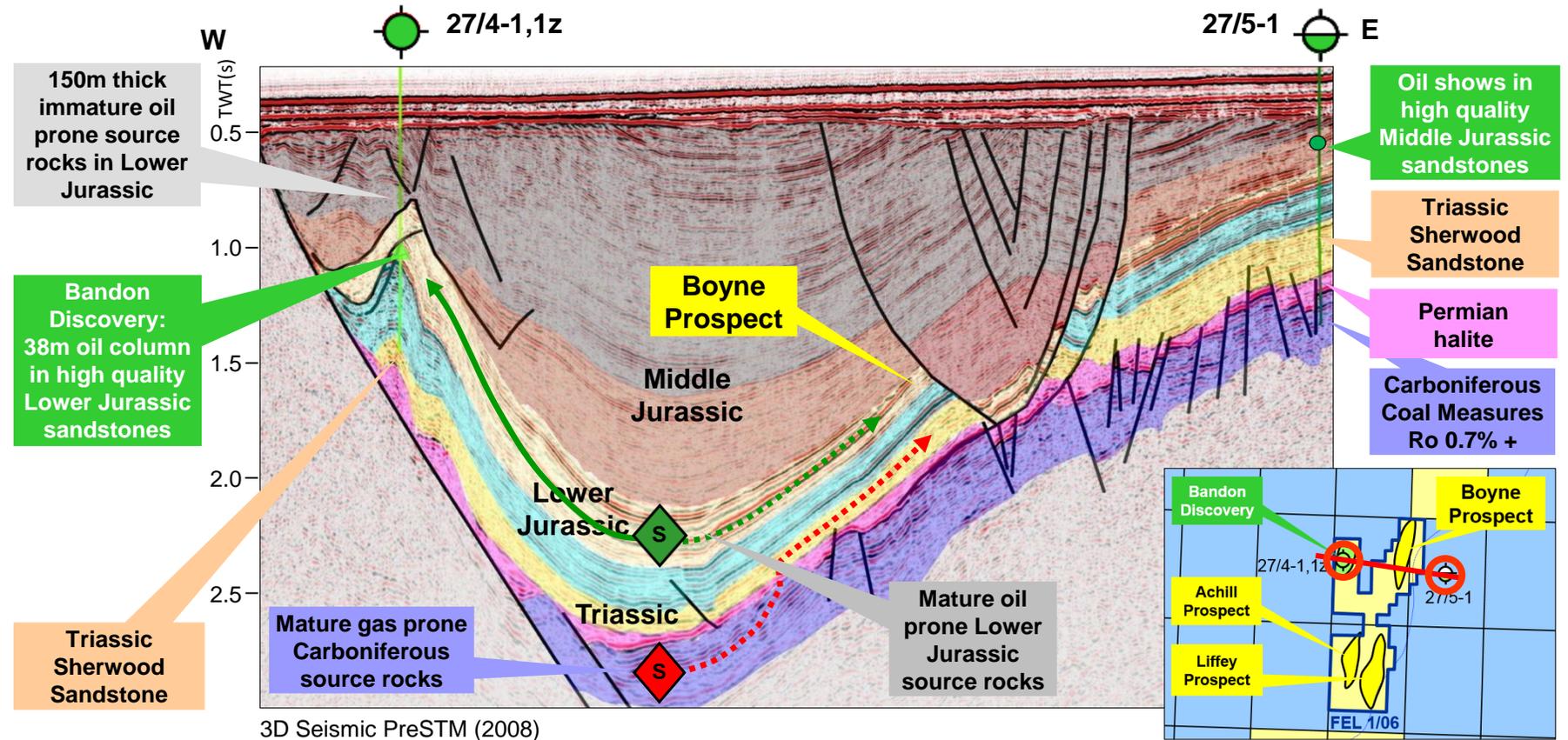
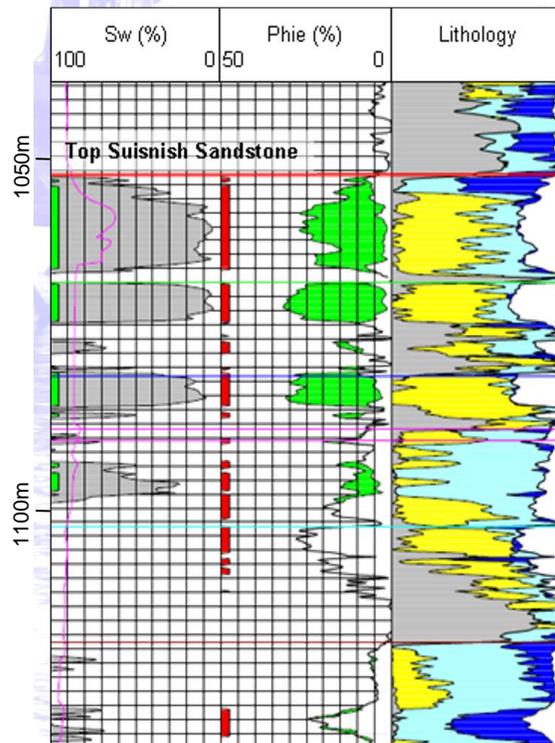


2D Seismic line and Top Sherwood Depth Map images from Corcoran & Mecklenburgh, 2005

Slyne Basin: Bandon Discovery

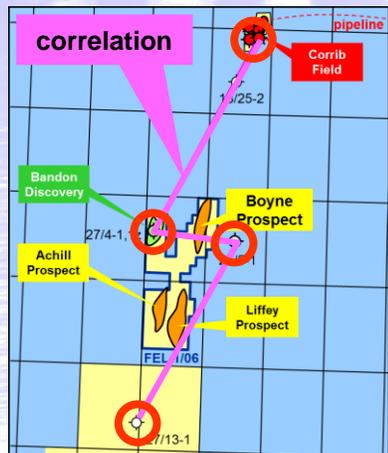
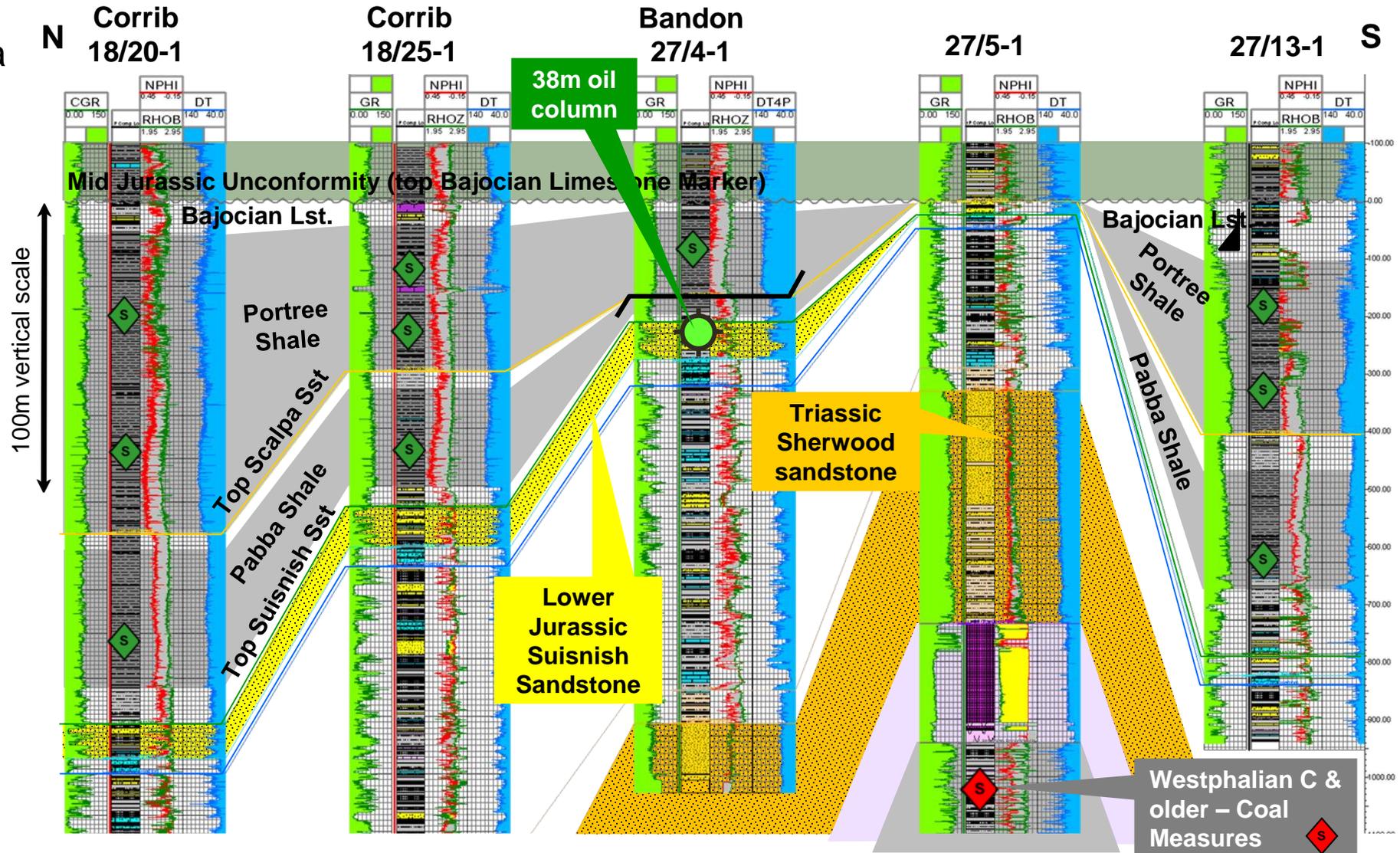
- Bandon Discovery: complex faulted anticline with 38m oil column in high-quality Lower Jurassic reservoirs
- STOOIP 12mmbbl proven within one fault compartment
- Proven Lower Jurassic oil source has de-risked the Jurassic play in the basin e.g. Boyne Prospect
- Triassic Sherwood Sandstone upside with Carboniferous gas source

27/4-1 log Interpretation



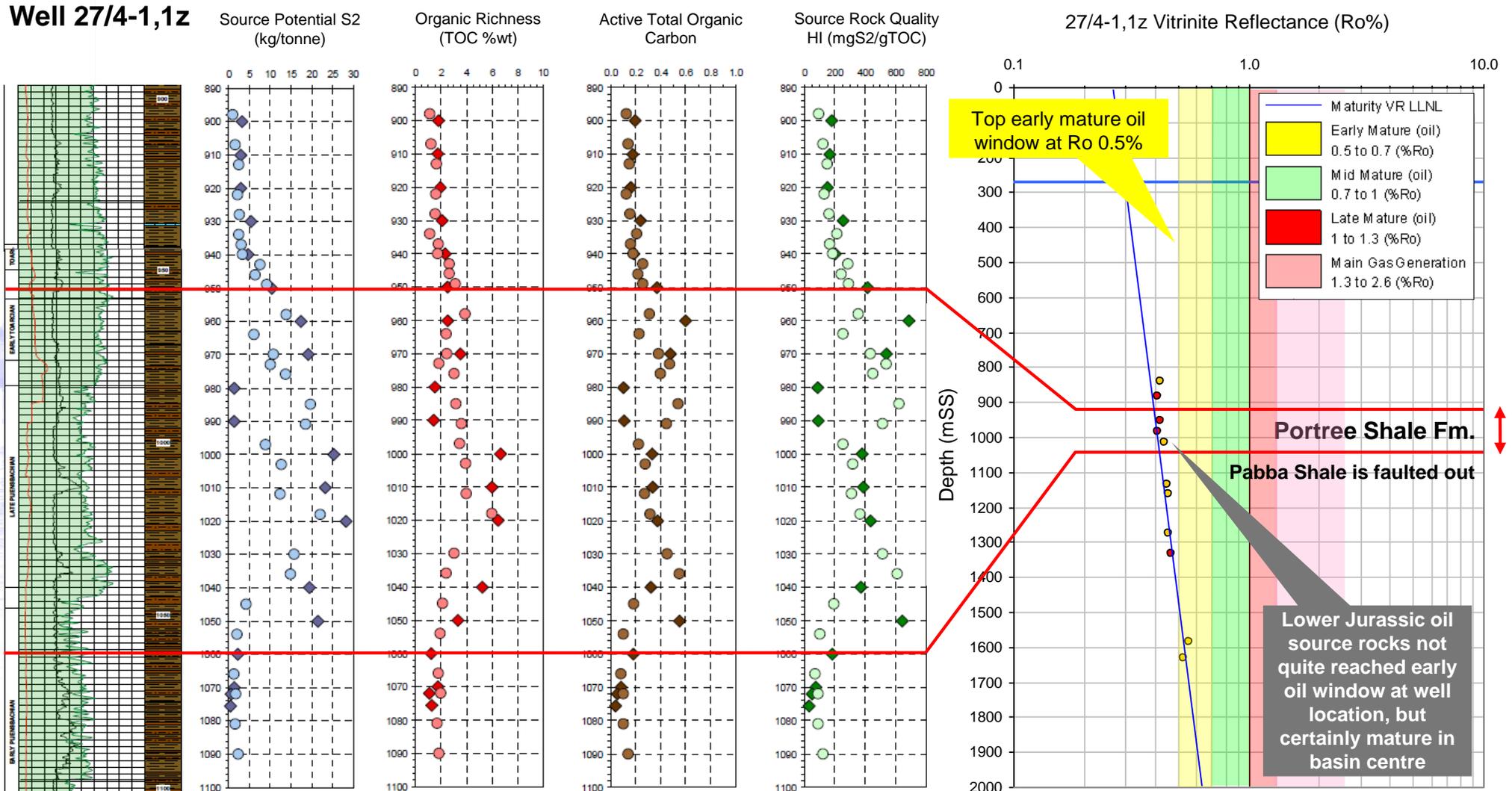
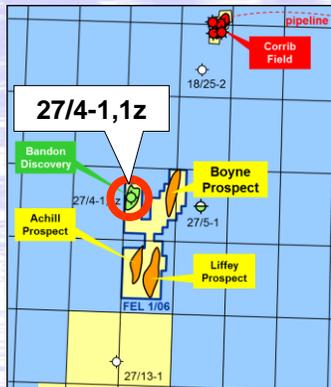
Slyne Basin: Source Rocks

- Extensive, thick Lower Jurassic Portree & Pabba Shale oil source in juxtaposition with reservoir sandstones
- Bandon Discovery has confirmed direct link between oil & source
- Deeper Carboniferous gas source can charge Triassic Sherwood Sst



Slyne Basin: Jurassic Source Rocks, 27/4-1,1z

- Portree Shale Formation Source rocks geochemically matched to 27/4-1/1z oil samples
- Immature at well location but mature in basin centre



Petroleum Systems of the Rockall and Slyne-Erris Basins: Conclusions

Despite limited drilling in Slyne-Erris & Rockall Basins, there are:

- **Proven reservoirs at multiple levels**
 - Cretaceous, Middle Jurassic, Lower Jurassic, Triassic, Permian, Carboniferous
- **Proven source rocks**
 - Lower Jurassic, Upper Jurassic, Carboniferous
- **Three hydrocarbon discoveries**
 - Dooish (gas-condensate), Corrib (gas) & Bandon (oil)

Improvements in seismic data quality coupled with falling costs of seismic data acquisition and drilling offer real opportunities to unlock value