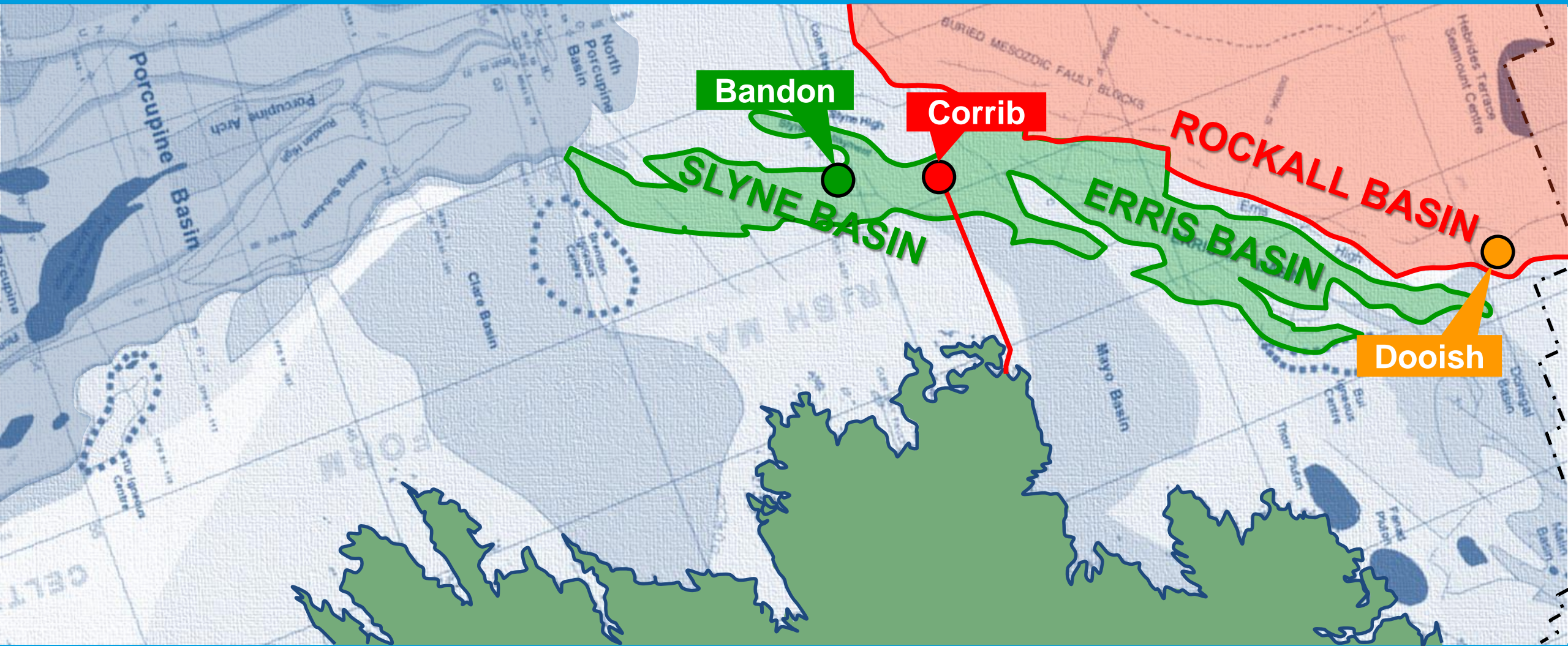


Key Elements of the Petroleum Systems of the Rockall and Slyne-Erris Basins



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

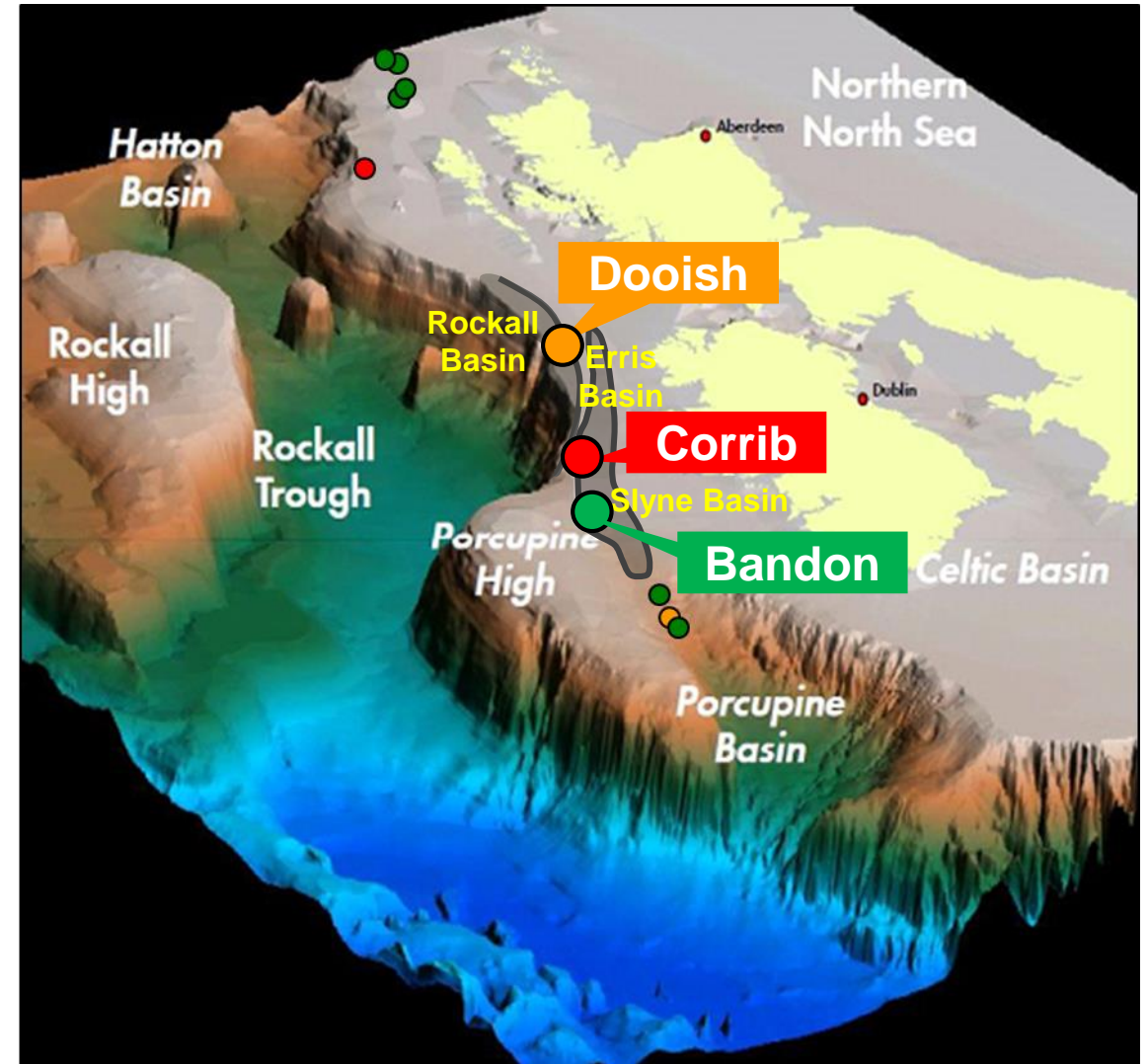


Image adapted from Onyeagoro et al, PESGB Lecture Abstract 2015

- Irish Atlantic shares geology with Newfoundland, UK, Faroe & Norwegian Atlantic margins
- Numerous rifted basins with more than one proven oil field
- 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)

Future plate boundaries

- Eocene
- Cretaceous
- E. Cretaceous ocean opening

Basins

- Cretaceous basin
- Jurassic basin

Oil Discovery as source

Faroe-Shetland Basin: Upper Jurassic (Kimmeridgian-Volgian) Kimmeridge Clay Fm. marine source

More Basin: Upper Jurassic (Kimmeridgian-Volgian) Kimmeridge Clay Fm. marine source

GREENLAND

NORWAY

Faroe-Shetland Basin

More Basin

(After Spencer & MacTiernan, 2001)

- Dooish (gas-condensate)
- Corrib (gas)
- Bandon (oil)

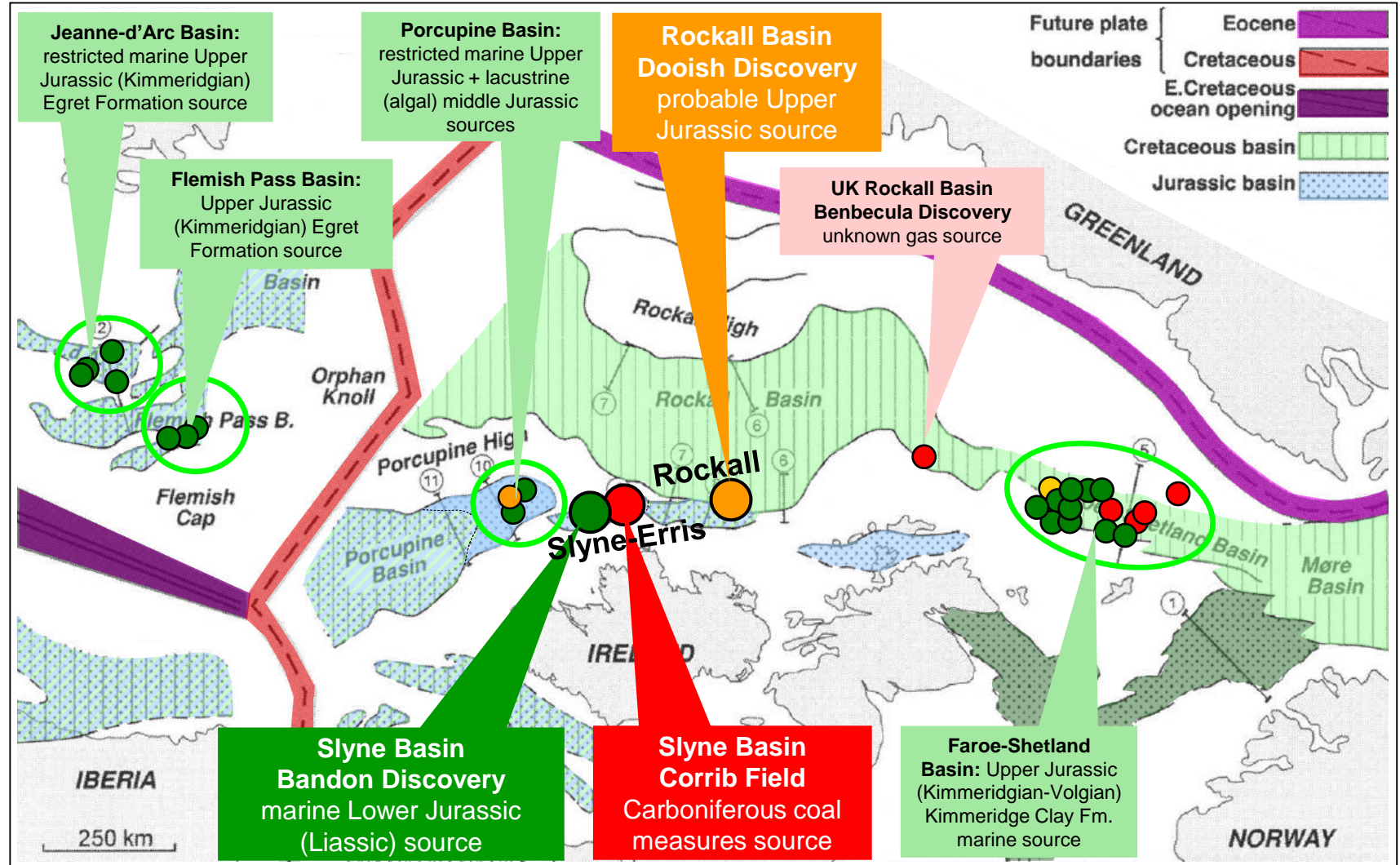


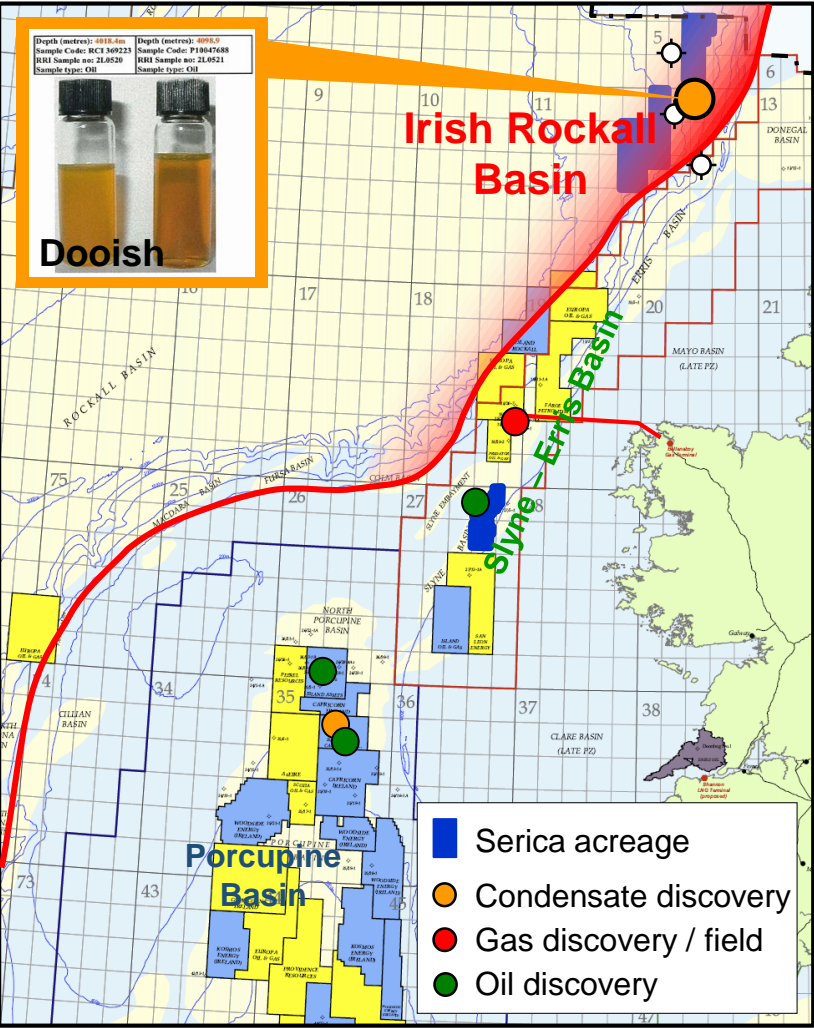
Plate Reconstruction at Barremian, 130 Ma

(After Spencer & MacTiernan, 2001)

Rockall Basin: The Key Play Elements



Location Map



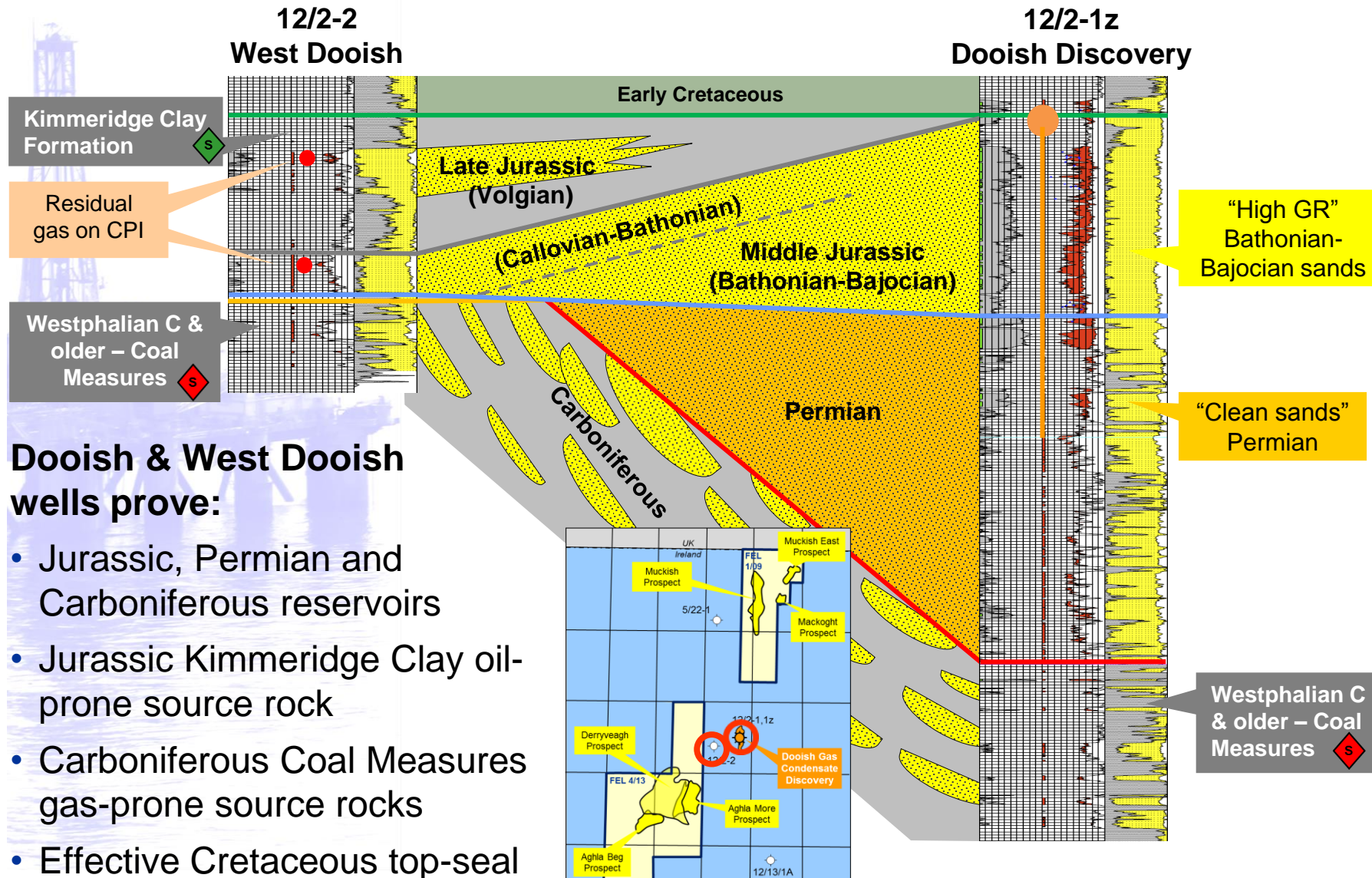
Map from PAD (2016)

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

| 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

SERICAENERGY

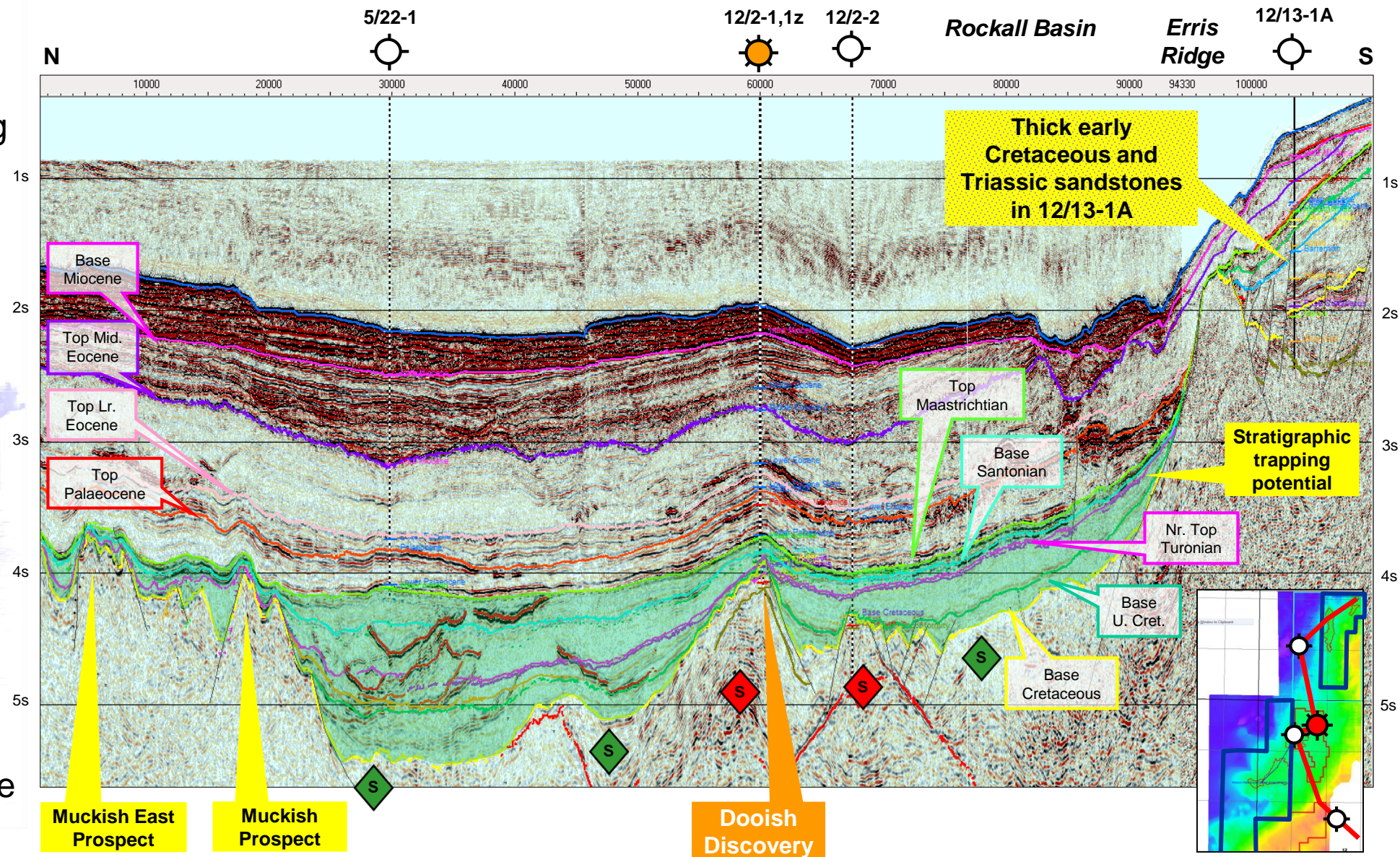


Dooish Discovery

- 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

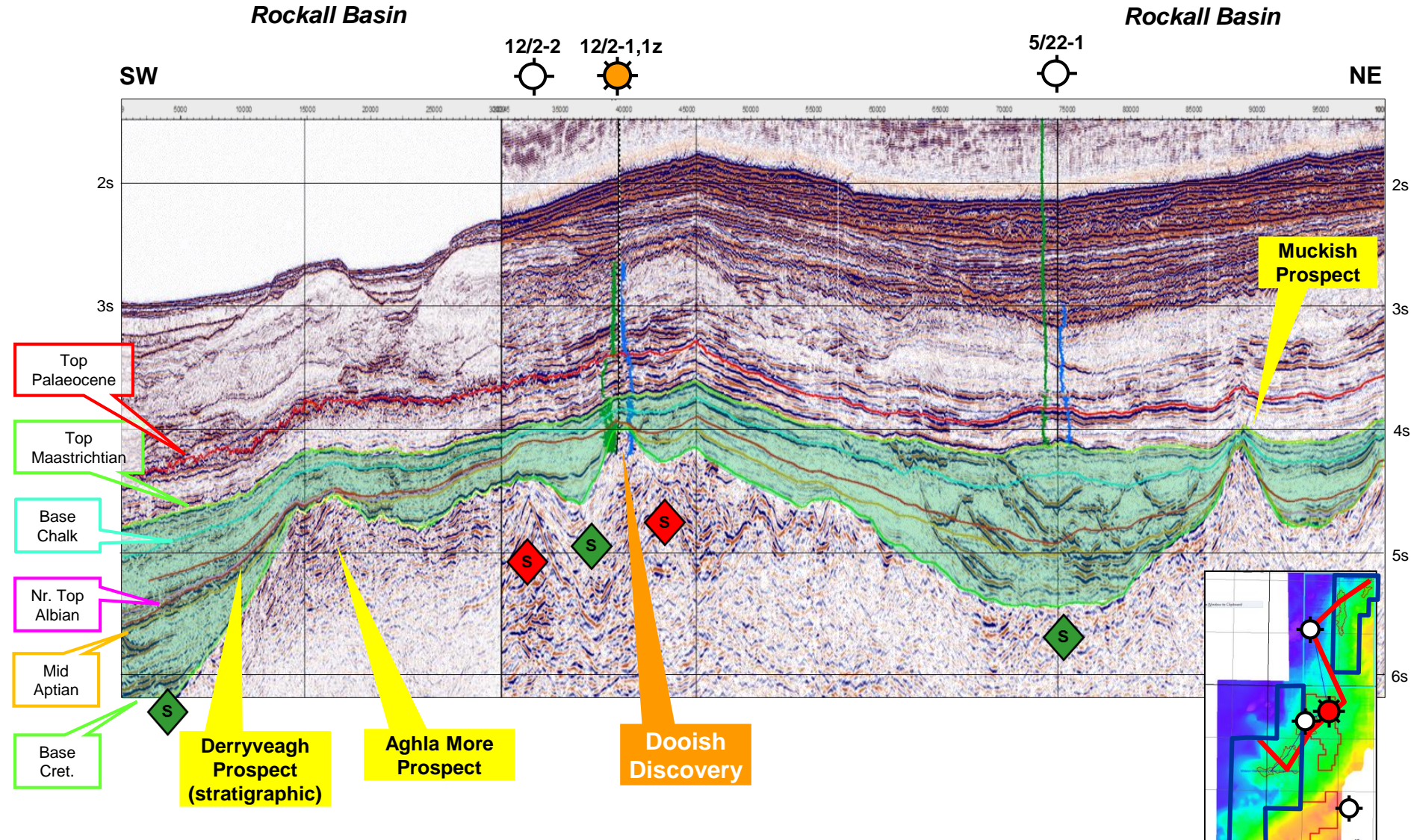
Rockall Basin: Regional Seismic Line (1)

- 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)

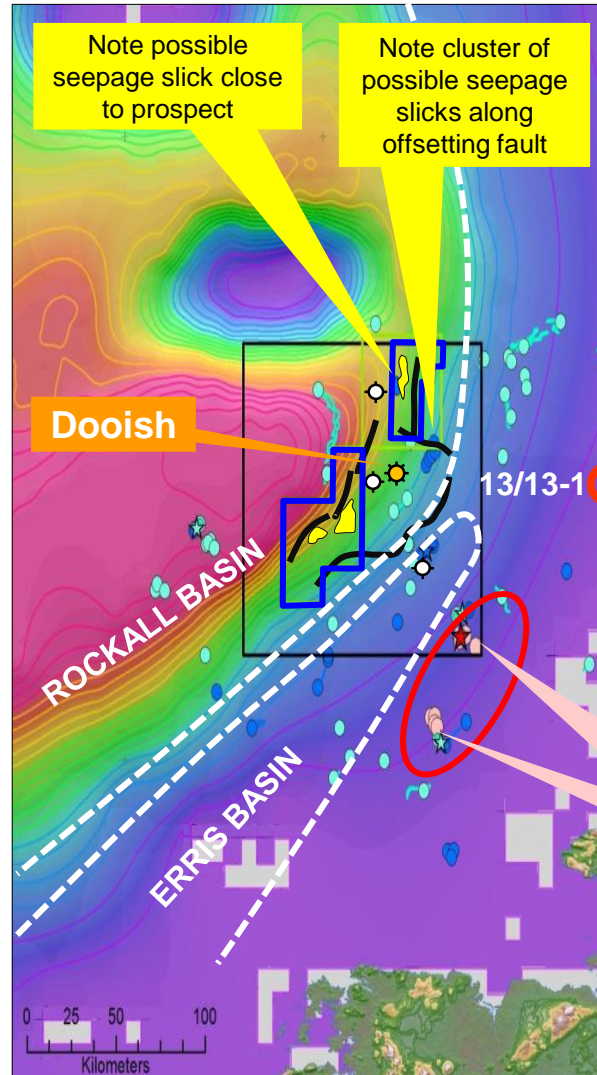
- Structural traps below Base Cretaceous including Dooish Discovery, Muckish and Aghla More Prospects
- Turbidite fans of Aptian-Albian including the Derryveagh Prospect
- UK West of Shetlands and Atlantic West Africa stratigraphic trapping analogues



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)



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

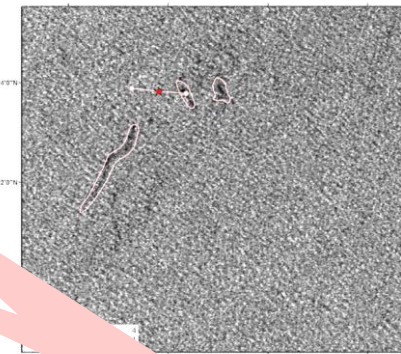
Sediment Thickness

Value

- High
- Low

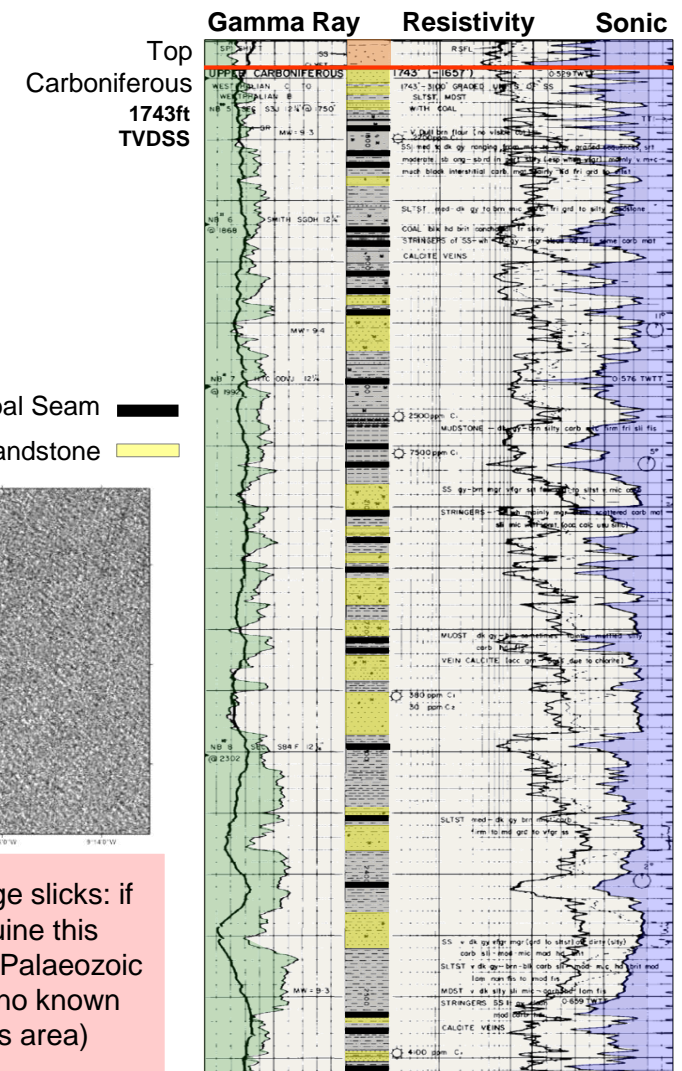
Coal Seam

Sandstone



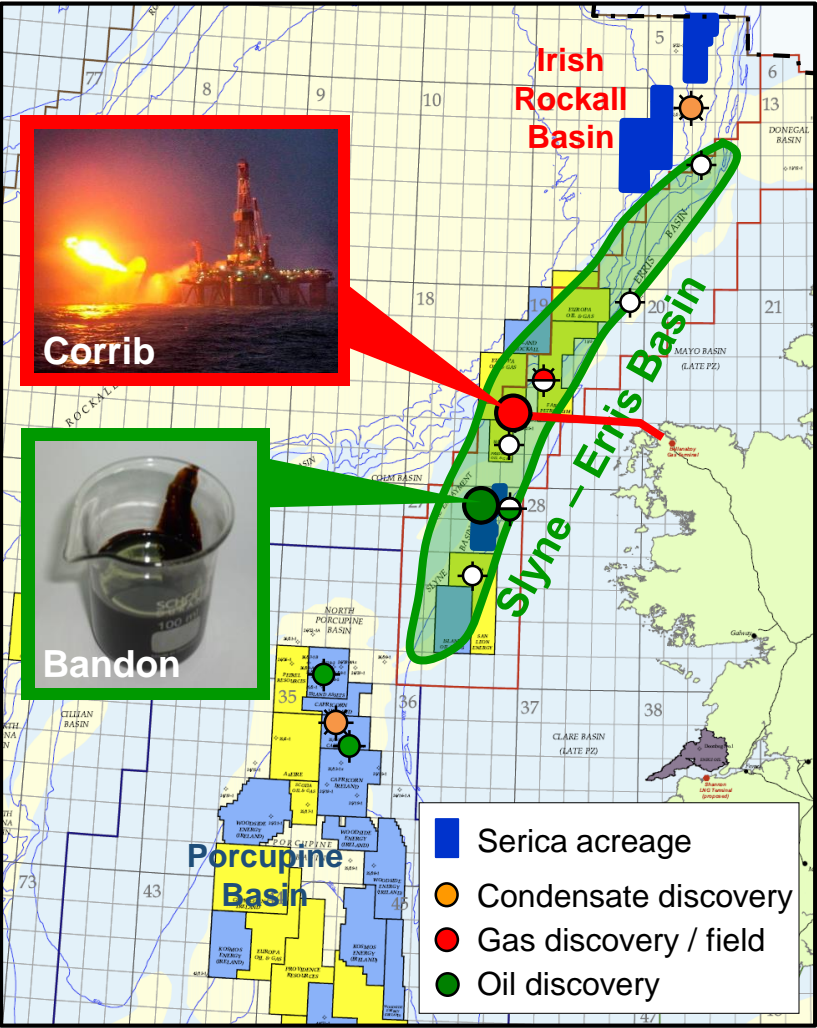
Repeated seepage slicks: if these are genuine this implies a working Palaeozoic source kitchen (no known Jurassic in this area)

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



Slyne - Erris Basins: The Key Play Elements

Location Map



Map from PAD (2016)

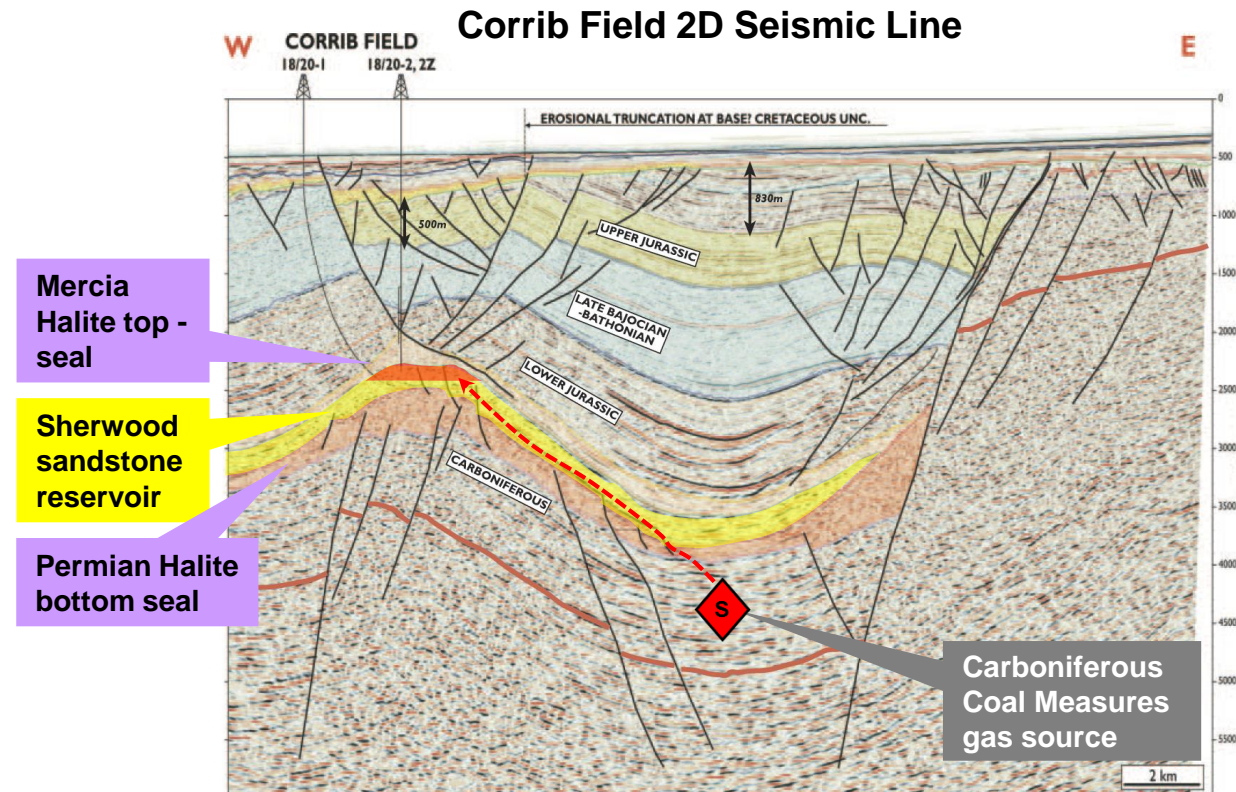
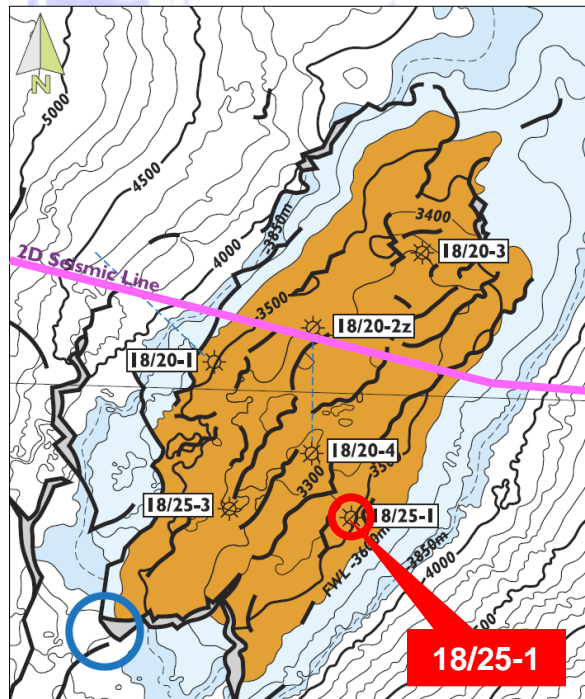
- Sandstone reservoirs
- Shale (oil) & gas (coal) source rocks
- Shale or salt regional top-seal

| 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 | |

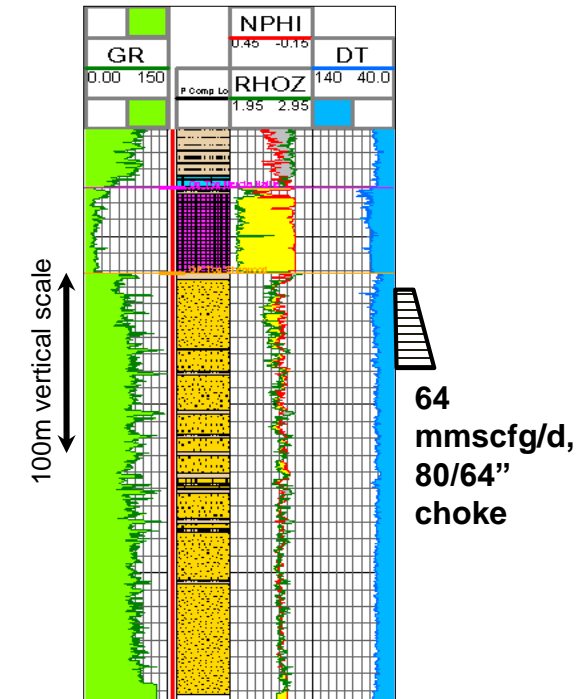
Slyne Basin: Corrib Field

- 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 64mmscfg/d

Corrib Field Top Sherwood Sandstone Reservoir Depth Map



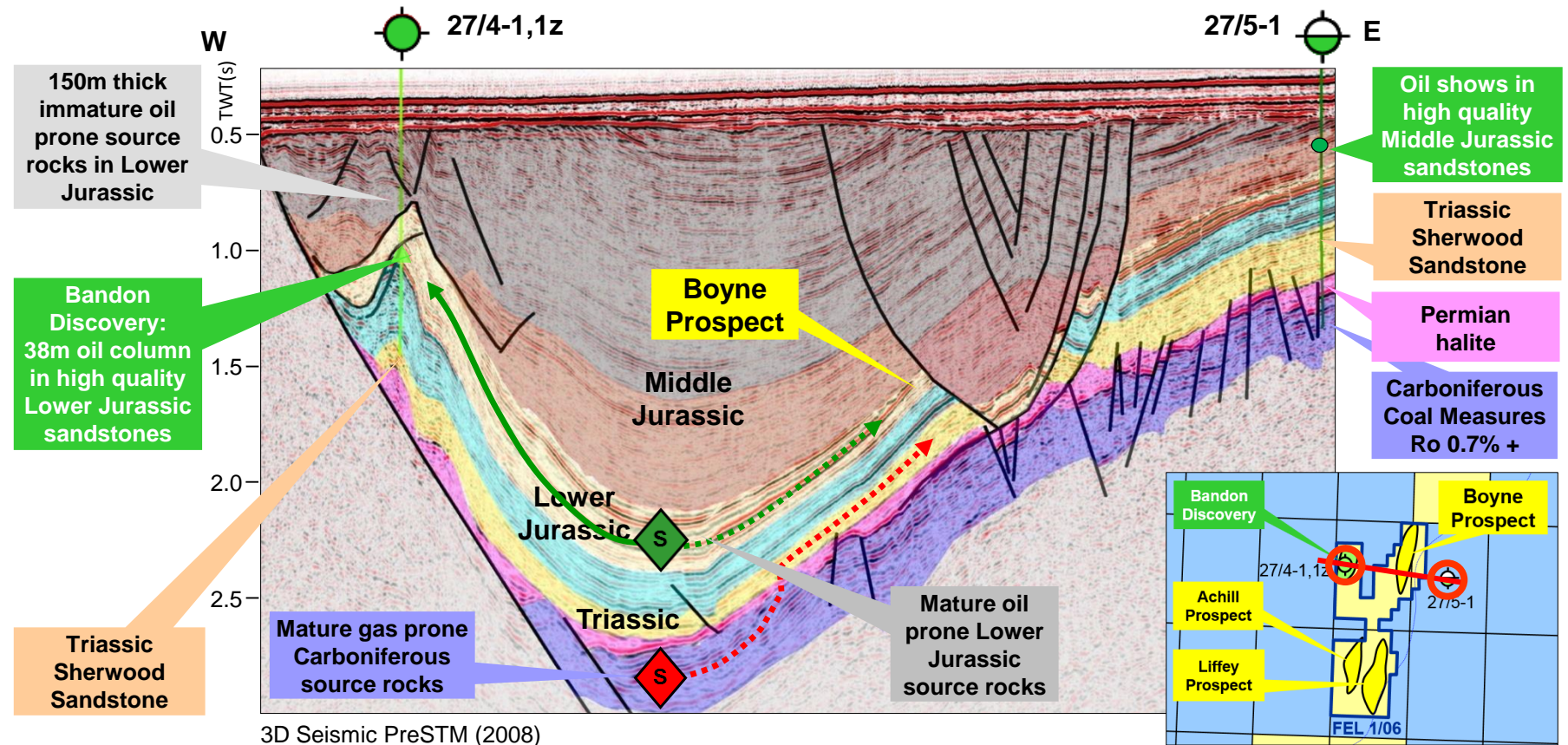
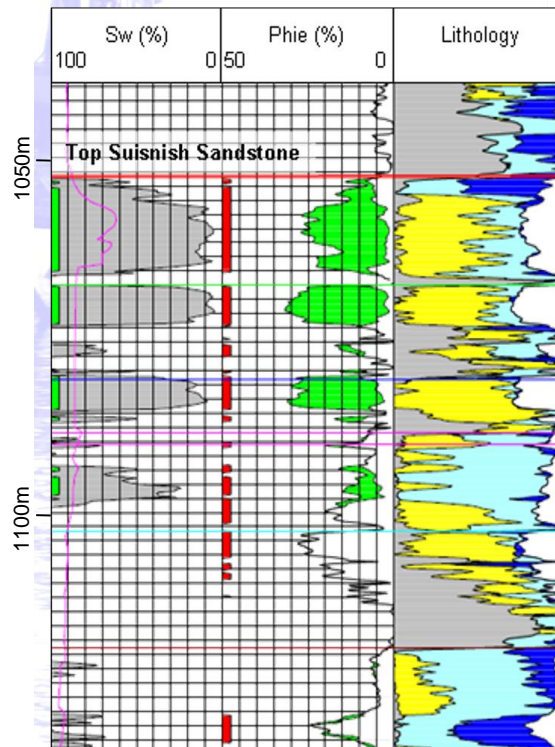
Corrib 18/25-1 Well



Slyne Basin: Bandon Discovery

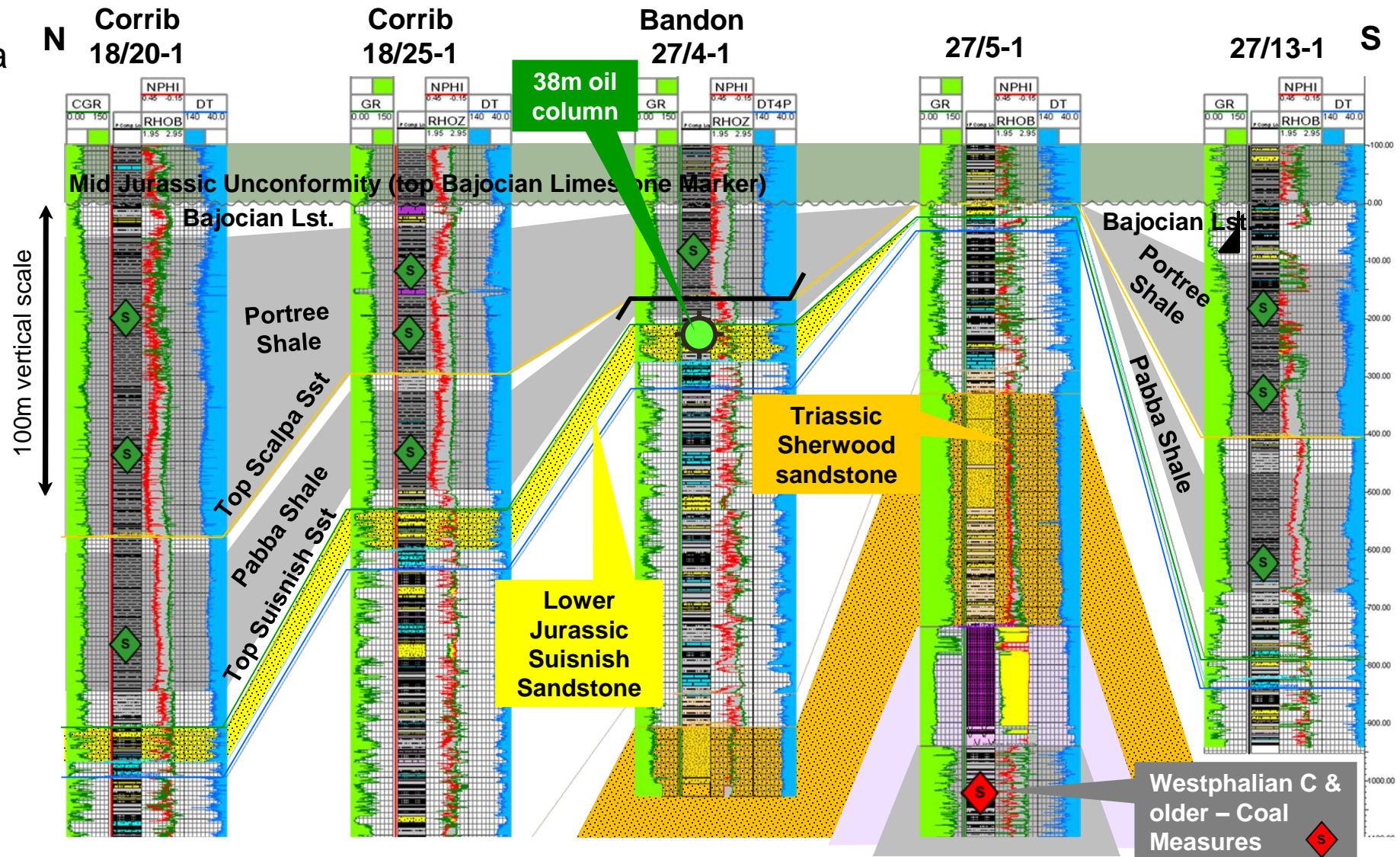
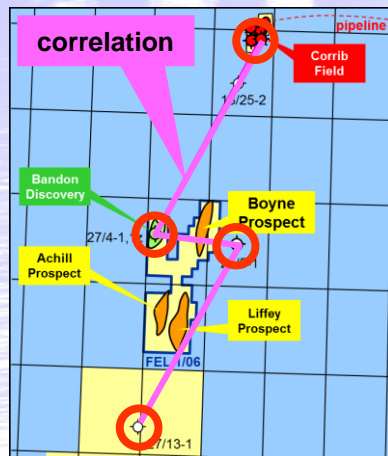
- Bandon Discovery: complex faulted anticline with 38m oil column in high-quality Lower Jurassic reservoirs
- STOOIP 12mmbo proven within one fault compartment
- Proven Lower Jurassic oil source has de-risked the Jurassic play in the basin e.g. Boyne Prospect
- Triassic Sherwood Sandstone upside with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

27/4-1 log Interpretation



Slyne Basin: Source Rocks

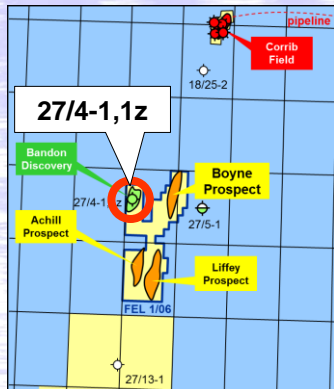
- Extensive, thick Lower Jurassic Portree & Pabba Shale oil source in juxtaposition with reservoir sandstones
- Bandon Discovery has confirmed direct link between oil & source
- Deeper Carboniferous gas source can charge Triassic Sherwood Sst



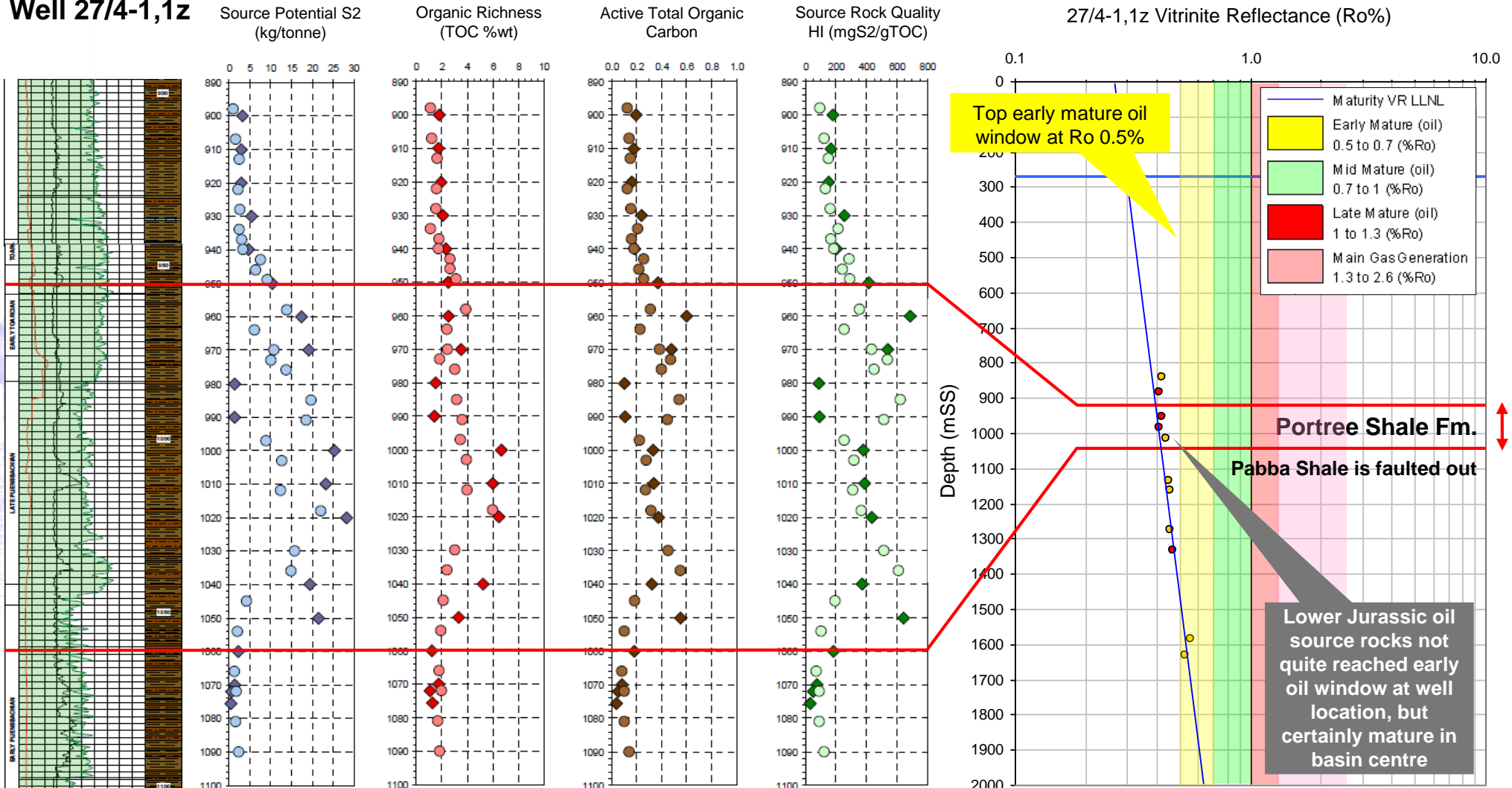
Slyne Basin: Jurassic Source Rocks, 27/4-1,1z

SERICAENERGY

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



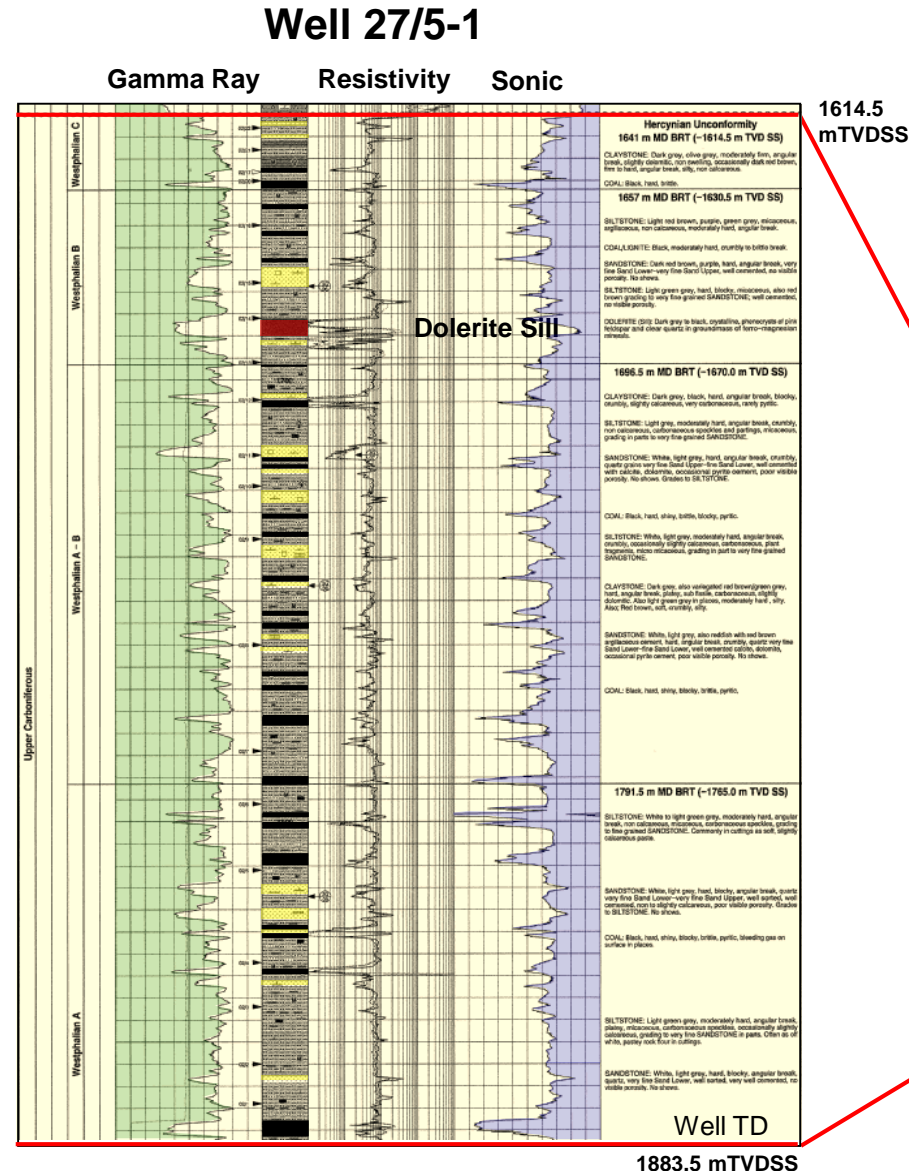
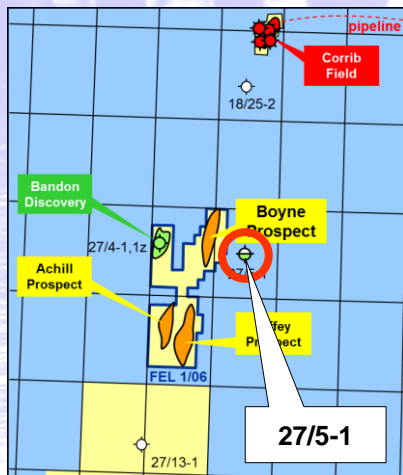
Well 27/4-1,1z



Slyne Basin: Carboniferous Source Rocks, 27/5-1

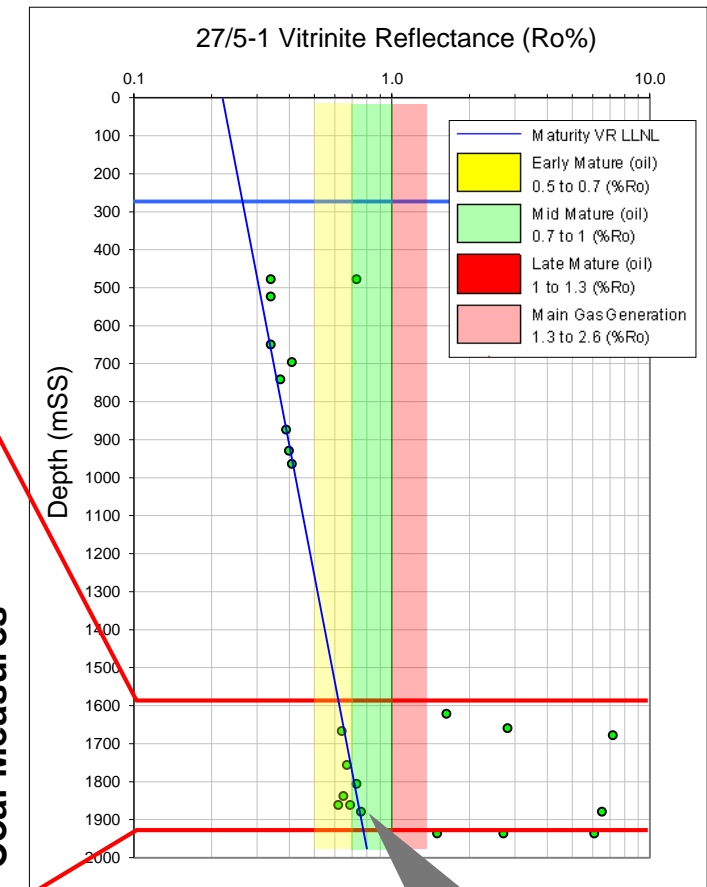
SERICAENERGY

- Thick coal measures (at least 270m) proven by 27/5-1 on the eastern flank of the Slyne Basin
- Immature for gas generation at well location, but mature in the basin centre



Carboniferous Coal Measures

Coal Seam
Sandstone



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