

# **The source for world class plays in the North Atlantic margins.**

**Patrick Barnard, Mark Bastow, Ian Cutler, Steve  
Killops, Julian Moore, Steve Thompson.**

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## How do we define the North Atlantic?

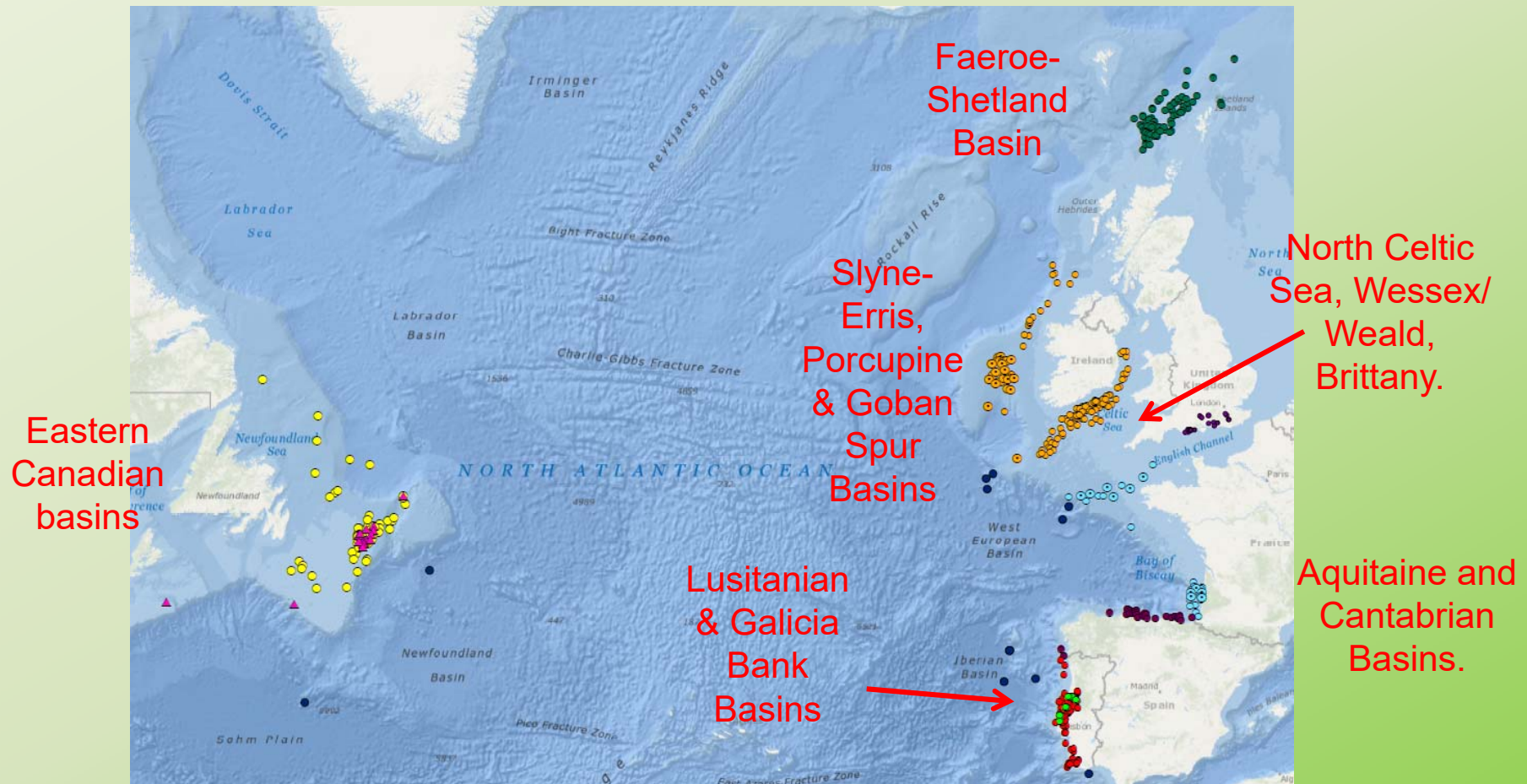
In term of present day geological structures we define the area as that lying between the Pico – East Azores Fracture Zones and the Wyville-Thompson Ridge.

In basin terms it captures all the principal basins between:

- In the west - Jeanne d'Arc, Flemish Pass, Orphan and St Anthony Basins;
- In the east - Algarve and Lusitania, Cantabria, Aquitaine, Wessex-Weald, North Celtic Sea & Fastnet, Porcupine, Slyne-Erris, Hebridean and Faeroe-Shetland Basins.

To evaluate the relationships between source rocks and oils we use a palaeogeographic basis to define the area of interest.

## North Atlantic source rocks. The study area.



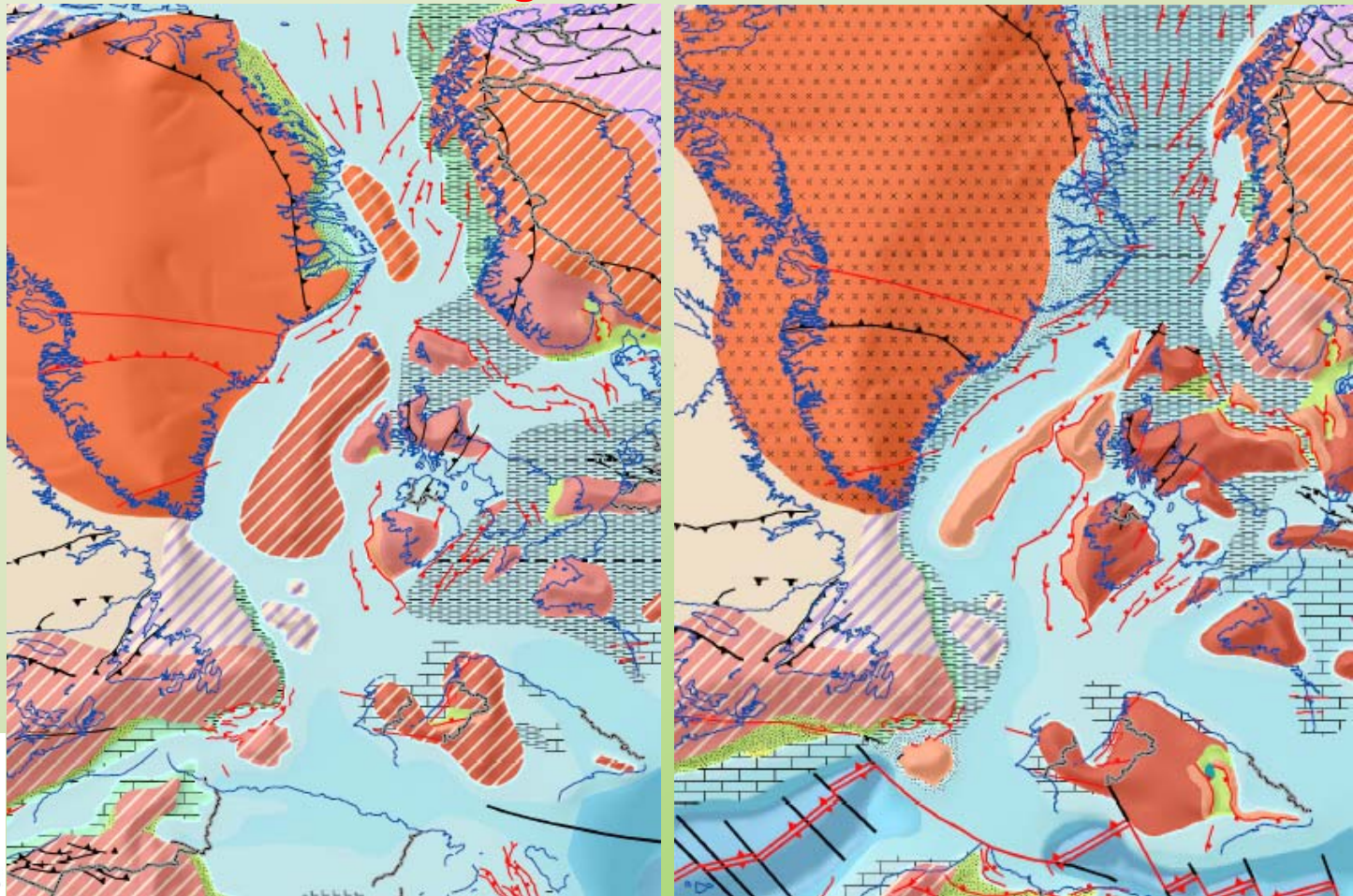


North Atlantic source rocks.

## Toarcian and Kimmeridgian re-constructions.



These preliminary re-constructions from GeTech for both the Toarcian and Kimmeridgian time slices, reveal a connected sea way from the Tethyan margins in the south through to the Boreal Ocean linking through Rockall and Hatton Troughs and the western margins of the British Isles.



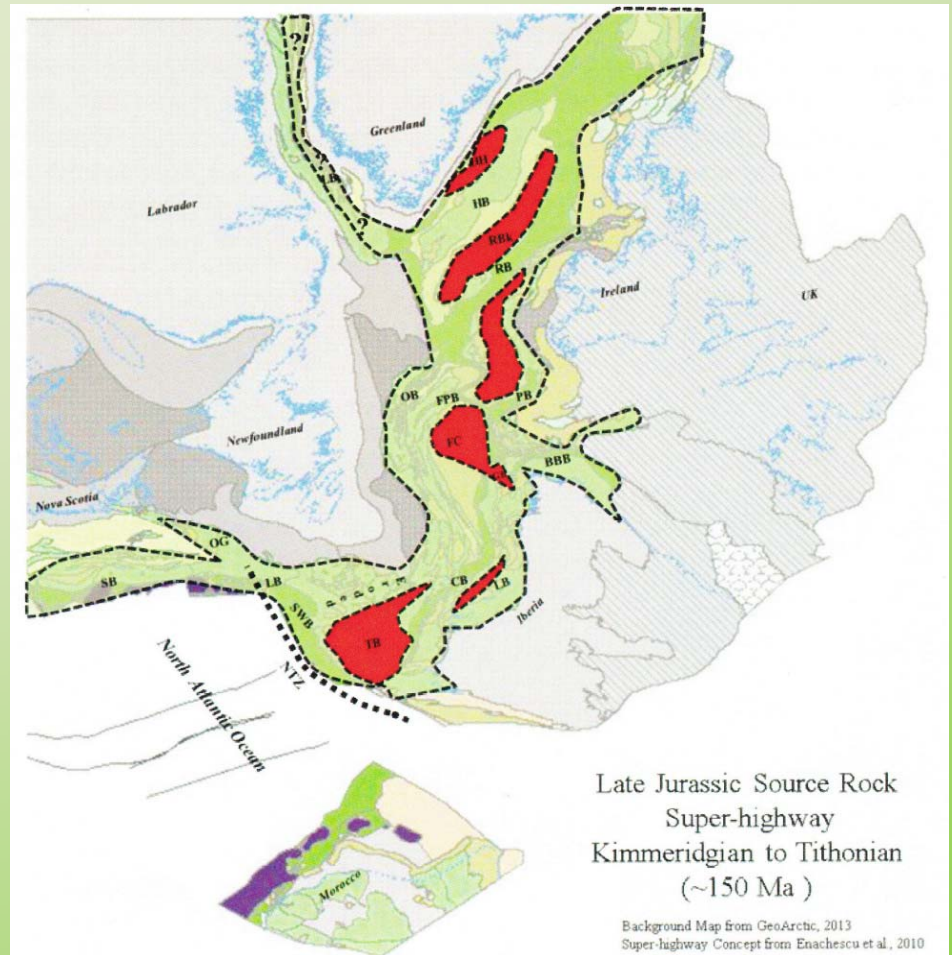
## North Atlantic source rocks.

### Connected source rock rich basins?



This concept of a string of connected basins containing Upper Jurassic source rocks was suggested by Enachescu, Atkinson, *et al.* in 2013.

“This proves that these two basins were part of the Kimmeridgian-aged source rock super-highway partially following the Atlantic rift trend connecting the Scotian Shelf to offshore Newfoundland basins and extending into the Porcupine, Rockall Trough and Slyne basins, West of Ireland and from here into the North Sea and Norwegian Sea basins and sub-basins.”





## North Atlantic source rocks.



### The Statoil view. Lower Jurassic and Kimmeridgian re-constructions.

These re-constructions from Statoil for both Lower & Upper Jurassic time, suggest much more limited connectivity between the Tethyan margins in the south and the Boreal Ocean.

The divergence between these two views has significant implications for the hydrocarbon prospectivity of these huge sea areas.

Palaeogeography after Scotchman, Dore & Spencer, 2016.

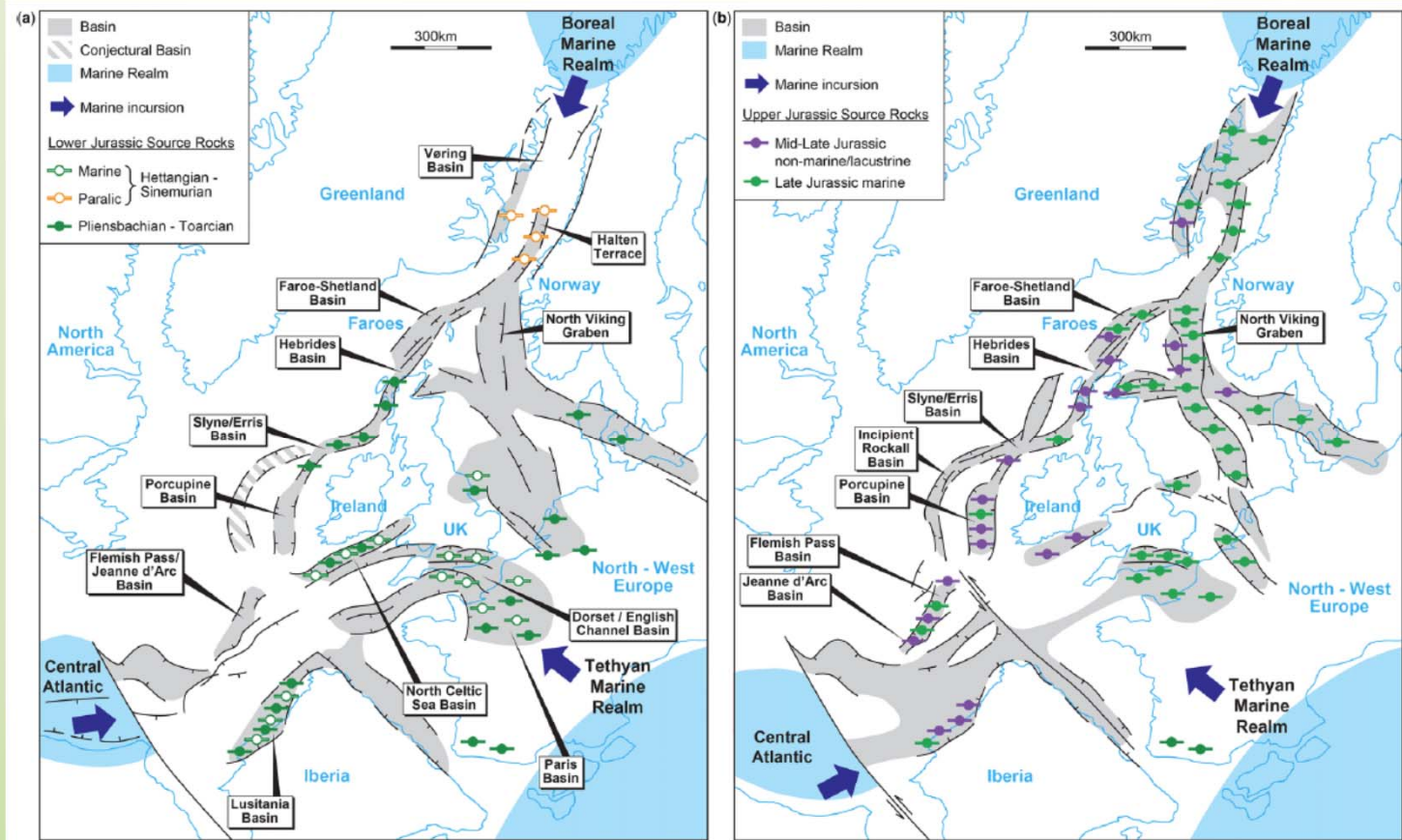


Fig. 5. Basin configuration and source rock distribution on the NE Atlantic conjugate margin basin: (a) Lower Jurassic; (b) Upper Jurassic.

## How do we decide which model to believe?

In the absence of wells proving rocks of Jurassic age in all of the many basins along and across the proto-Atlantic it is difficult to demonstrate the presence of a sea way connecting south to north.

We therefore rely on detailed studies of the rocks in the basins that have been explored to test ideas of connectivity.

The geochemical characteristics of rocks and oils can provide relevant data to predict:

- depositional setting - marine, lacustrine, brackish or fresh water;
- climatic influences - equatorial, monsoonal, temperate;
- organic productivity - nutrient supply & source – up-welling, rivers;
- hinterland contribution - land derived or marine plants;
- water mass chemistry - stratified, salinity or thermocline.

## North Atlantic source rocks.



### What have we done?

**APT has carried out a study of all available material from across the area utilising:**

- Legacy screening data sets from many different sources;
- New high resolution biomarker and isotope analyses on oils, shows & source rocks;
  - 74 oils (all taken through to GC-MS);
  - ±1030 source rock samples screened for TOC of which ±700 for pyrolysis and ±90 taken through to GC-MS;
  - ±400 logged oil shows screened for oil presence; ±120 taken through to GC-MS.

**Interpretation and integration work aimed at:**

- Identifying and characterising the generative source rocks (Lower, Middle or Upper Jurassic);
- Better understanding the Tethyan source depositional environment;
- Geochemically correlating the analysed oils with the identified source rocks;
- Providing compatible geochemical fingerprint comparisons between basins in order to provide evidence capable of either disproving or allowing the possibility of inter-basin (reconstructed) connectivity;
- Interpreting extracted oil stains to check for missed source plays.



## North Atlantic source rocks.



Summary listing of samples acquired and submitted for high resolution analyses as part of recent APT regional studies along the North Atlantic margins.

Area	Oils	Gases	Well & field samples	Source rocks		Shows	
				Screen	GCMS	Screen	GCMS
West of Shetlands	32	45	433	195	49	238	159
Porcupine (old)	9	0	137	35	10	102	53
Eastern Canada	36	0	472	264	24	208	42
Portugal	9	0	274	188	26	86	20
France & Spain	6	0	0	0	0	0	0
Ireland (new)	8	4	114	104	9	10	6
UK	5	1	79	76	21	3	2
DSDP / ODP (new)	0	0	91	91	3	0	0
Total samples	105	50	1600	953	142	647	282

North Atlantic source rocks.



## Details of the study

The results presented in the conference session are part of a commercially available study which is presently being marketed by APT UK. Contact Helen Kerr ([hmk@aptuk.co.uk](mailto:hmk@aptuk.co.uk)) for further information.