Challenge 2: Resources, Reserves and the Future

Current project status and updates

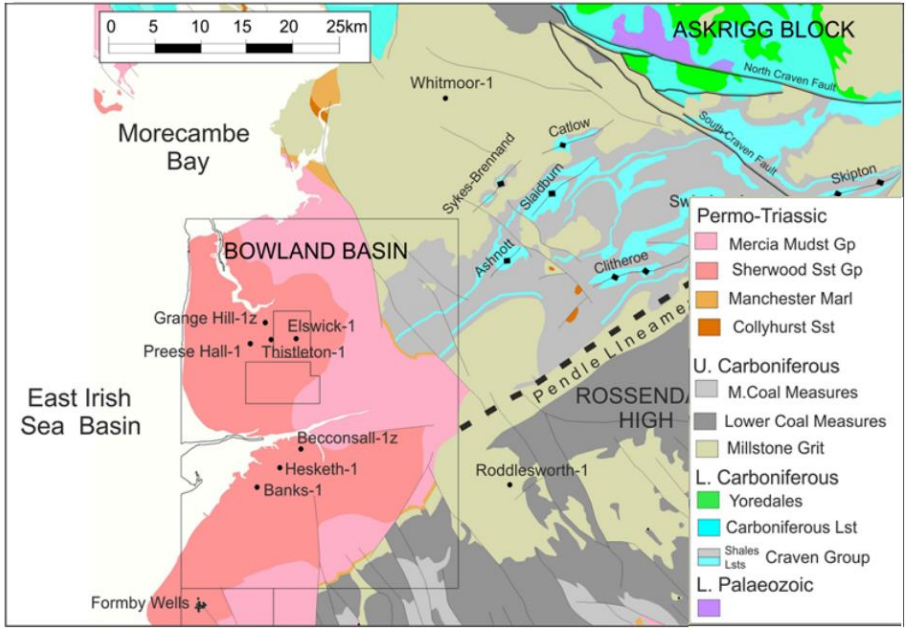
Bhavik Harish Lodhia, Alastair J. Fraser

Overview

- C2 aims
- Introduction to petroleum systems modelling
- Bowland Basin resources
- Updates from C2 partners at BGS and University of Leicester
- Drawbacks due to Covid-19
- Future direction

Introduction

- C2: Shale resource potential, distribution, composition, mechanical and flow properties
- Geological and petroleum systems modelling using PetroMod™ – reservoir modelling at the basin scale
- Maturity, temperature, porosity (etc.) data used to calibrate
- Calculates hydrocarbon generation, expulsion and fluid migration through subsurface

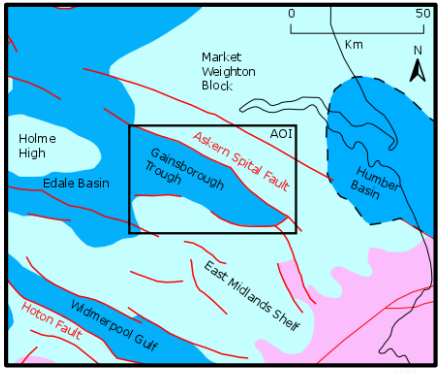


Clarke et al. (2018)

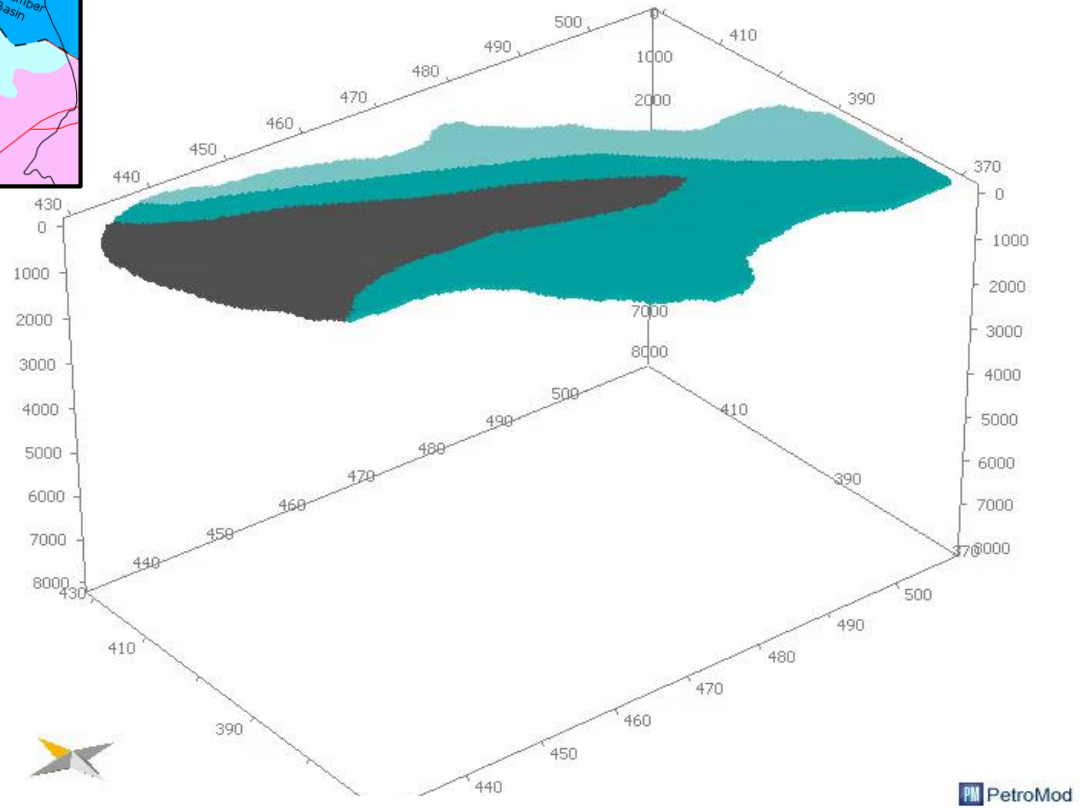
Petroleum systems modelling

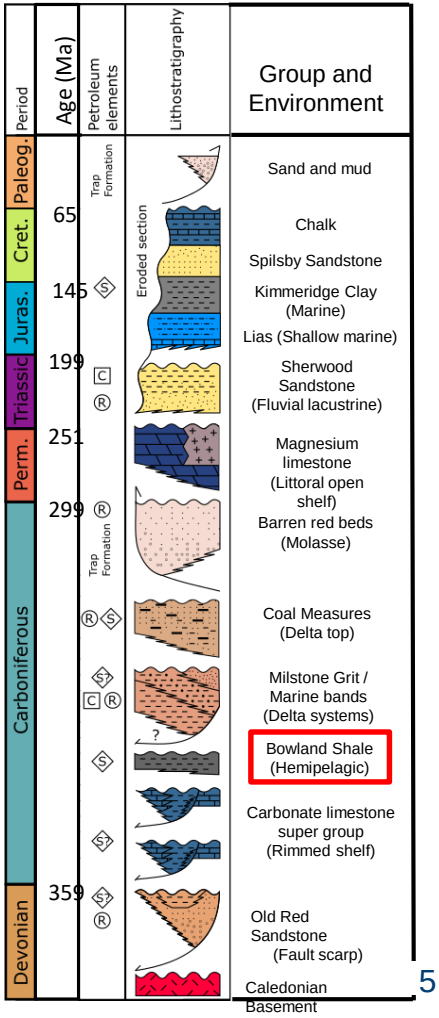
- Map key sub-surface stratigraphic horizons, faults and structures using geophysical data (e.g. seismic)
- Apply well, biostratigraphic and geophysical data to infer lithologies across basins
- Input thermal/erosion histories and calculate source rock properties (TOC, HI, kinetics)

Gainsborough Trough, East Midlands



Platforms
Basins
Land mass

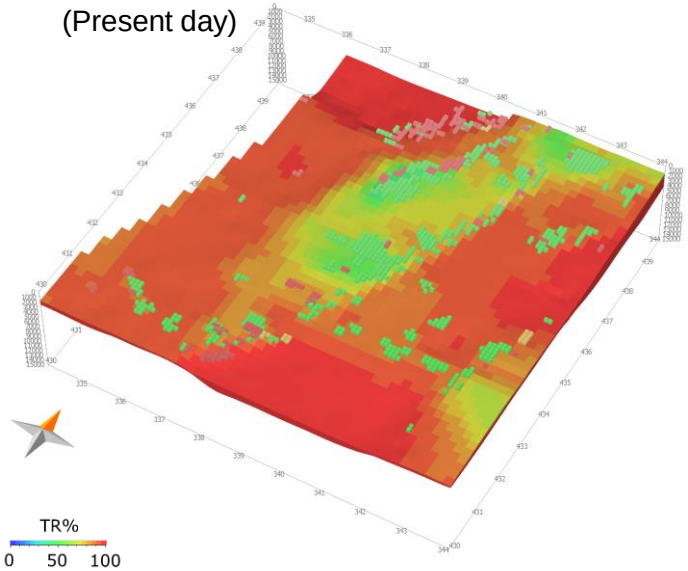




Palci et. al (2020) Shale oil and gas resource evaluation through 3D basin and petroleum systems modelling: a case study from the East Midlands, onshore UK

Resource estimate

Transformation Ratio Upper Bowland Shale (Present day)



- Preliminary petroleum systems modelling results indicate ~206 Tcf GIP in Upper and Lower Bowland Shales
- 10% recovery (could be lower in deep shales) gives resource of approx. ~20 Tcf gas
- UK gas consumption is ca. 2.8 Tcf/year
- Bowland Basin gas resource may provide ~7 years domestic gas supply

Lodhia et al. (in prep)

Problems and C2 partner updates

- UK-wide moratorium on hydraulic fracturing and shale gas operations since November 2019
- Covid-19 delays to project by > 6 months due to lack of lab access etc.
- BGS and Leicester collaboration: delay to fracture tests (Jan Hennissen, Kieran Blacker, Paul Monks)
- Experimental hyperspectral-IR core scanning delayed, due to resume in Autumn 2020 (Kieran Blacker, Tim Pritchard)
- Heriot-Watt and Bristol delays to postdoctoral research associate commencement

Future direction

- CO2/CH4 adsorption and desorption experiments by Ansari et al. (2018) (Imperial) indicate 7 x affinity for CO2 in shales
- CO2 adsorbed to surface of shales, not held as free gas (e.g. conventional CCS)
- Can CO2 displace CH4 in the Bowland Shale for low (or negative) carbon resources?
- Key recent commercial boreholes at PNR, Spings Road as potential laboratories
- Discussions ongoing – with operators Cuadrilla and IGas

Future direction

- Sweet spot mapping of Bowland Basin to identify gas accumulations
- Develop methodology to substitute CO2 injection into shales in petroleum systems modelling
- Laboratory experiments to determine CO2/CH4 adsoption and desorption properties of Bowland Shale
- Goal: ‘CO2 in, CH4 out’ estimate, feasibility of CO2 sequestration process in shale

Thank you!