



Thermal Maturity of selected Carboniferous onshore basins in Ireland and its impact on carbon dioxide storage and methane recovery

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Introduction

There is a proven link between climate change and increase of Carbon Dioxide (CO₂) in the atmosphere from anthropogenic sources.

Carbon Capture & Sequestration (CCS) will enable storage of large amounts of CO₂ in deeply buried geological formation for long period of time (Bachu, 2003).

The best reservoirs are those where methane can be produced by injection of CO₂.

Estimated shale oil and shale gas resources represents 10% of the world's crude oil and 32% of the world's natural gas technically recoverable resources.

There is evidence that in coals, CO₂ adsorption decreases with increasing rank (Eble, 2010).

Methodology

- Vitrinite Reflectance (R_{oran}) is being used in this study in order to determine the maturity of Carboniferous shales & coals.
- Previous R_{oran} published data were collected and a database has been created.
- The data were sorted so that three 'times-slices' with R_{oran} values ranging from 0.6 to >4% could be produced:

- 1- Base Carboniferous (Fig. 2a)
- 2- Base Chadian (Fig. 2b)
- 3- Base Westphalian (Fig. 2c)

- Samples were collected from GSI 09/04 (Clare Basin) and GSI 13/01 (Dublin Basin) boreholes.
- TOC, Rock-Eval pyrolysis and R_{oran} were ran on these samples (Fig. 3 & 4).

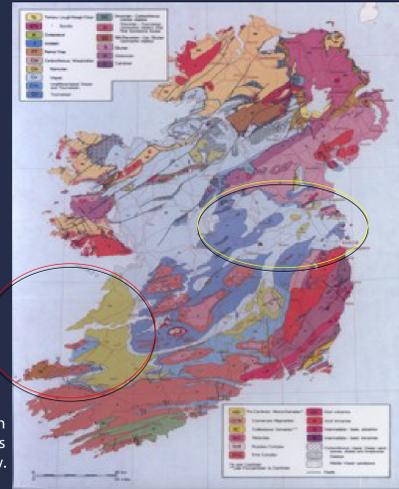


Figure 1. Study Areas: The Calre Basin is shown in red and the Dublin Basin is shown in yellow.

GSI 13/01 (Dublin Basin)

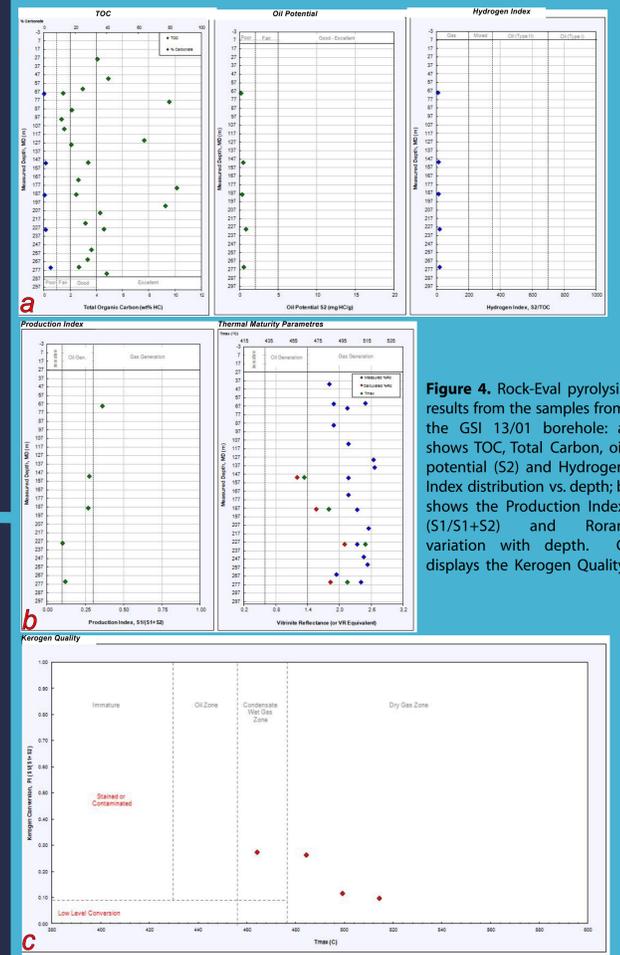


Figure 4. Rock-Eval pyrolysis results from the samples from the GSI 13/01 borehole: a shows TOC, Total Carbon, oil potential (S2) and Hydrogen Index distribution vs. depth; b shows the Production Index (S1/S1+S2) and R_{oran} variation with depth. C displays the Kerogen Quality

GSI 09/04 (Clare Basin)

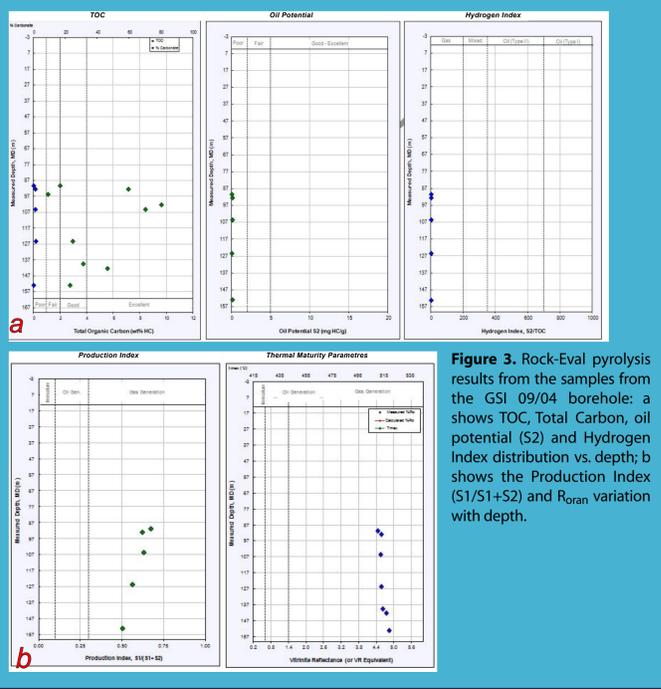


Figure 3. Rock-Eval pyrolysis results from the samples from the GSI 09/04 borehole: a shows TOC, Total Carbon, oil potential (S2) and Hydrogen Index distribution vs. depth; b shows the Production Index (S1/S1+S2) and R_{oran} variation with depth.

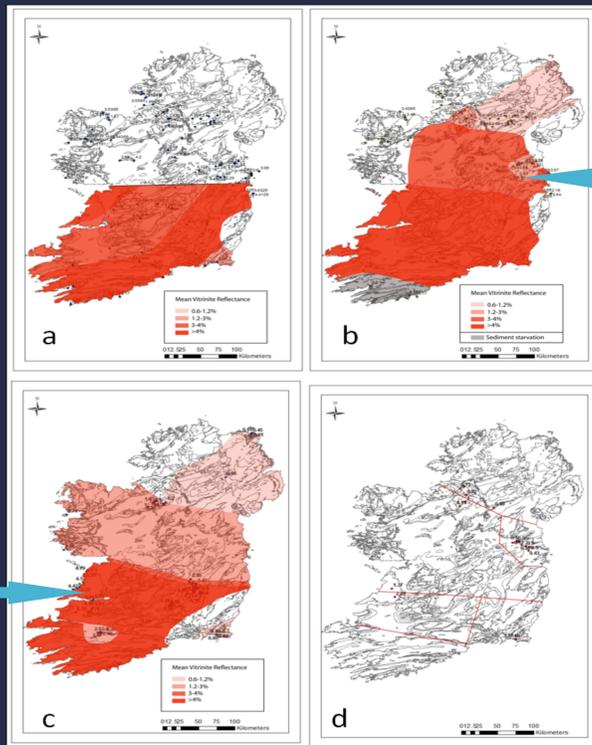


Figure 2. Mean Vitrinite Reflectance data distribution in Ireland for a) the Base Carboniferous, b) the Base Viséan and c) the Base Westphalian. In the figure d is displayed the gradient map that was used to extrapolate vitrinite reflectance data that were not available.

Results

- 1- The maturity shows an increase that could be caused by burial in the northern part and in the Dublin Basin, while is more complex in the southern part since there is no evident gradient.
- 2- From a TOC point of view most of the samples from both boreholes vary from good to excellent.
- 3- Rock-Eval analysis confirmed the Vitrinite Reflectance measurements and the S2 peaks recorded were very low and almost non detectable (GSI 09/04).
- 4- The Carboniferous black shales in the Clare Basin appear to be post-mature, while the ones in the Dublin Basin are in the dry gas window.

References

Bachu, S., 2003. Screening and ranking of sedimentary basins for sequestration of CO₂ in geological media in response to climate change. *Environmental Geology*, 44, 277–289.

Eble, C., Greb, S., Nuttall, B., McClure, M., Conrad, M., Grimm, R., 2010. Factors Affecting the Gas Content of Pochaontas Basin Coal Beds, SW Virginia: Implication for Coal-Based Carbon Capture/Storage and Enhanced Coal Bed Methane Production. Unpublished presentation, Geological Society of America Meeting, Denver 2010.

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