CARBON SEQUESTRATION IN CARBONIFEROUS BLACK SHALES IN IRELAND

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Figure 1. Areas considered. Each number refers to the section number

Introduction

- There is a proven link between climate change and increase of Carbon Dioxide (CO_2) in the atmosphere from anthropogenic sources.
- Carbon Capture & Sequestration (CCS) will enable storage of large amounts of CO_2 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 CO_2.
- Adsorption capacity of a coal depends on many parameters, including permeability, porosity, temperature, pressure, gas composition, moisture content, maturity and surface area of the reservoir rocks.
- There is evidence that in coals, CO_2 adsorption decreases with increasing rank (Eble, 2010).
- Organic rich shales apparently behave like coals in terms of CO_2 adsorption.

Methodology

- Vitrinite Reflectance (Rr) is being used in this study in order to determine the maturity of Carboniferous shales & coals, because increases uniformly with temperature and is therefore a perfect tool to determine hydrocarbons generation & CCS potential.
- Previous Rr published data were collected and a database has been created.
- The data were sorted so that three 'times-slices' could be produced:
  1- Base Carboniferous (Fig. 3a)
  2- Base Chadian (Fig. 3b)
  3- Base Westphalian (Fig. 3c)
- A gradient map was created (Fig. 3d) so that Rr data could be extrapolated between the Base Carboniferous and the Base Chadian to fill gaps.
- The palaeogeography was taken into account for the three maps (Sevastopulo, 2009).

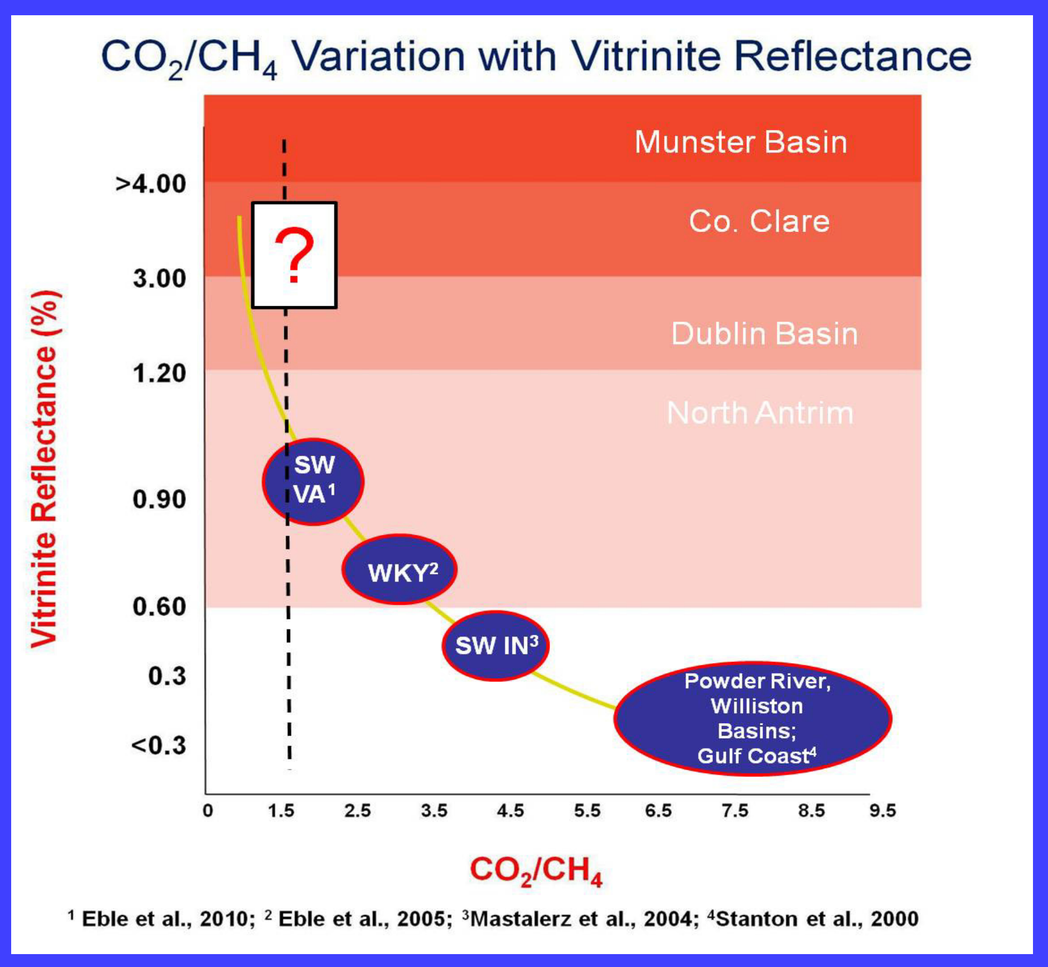

Figure 2. CO_2/CH_4 variation with Vitrinite Reflectance. Samples from previous published data from the USA are displayed in blue

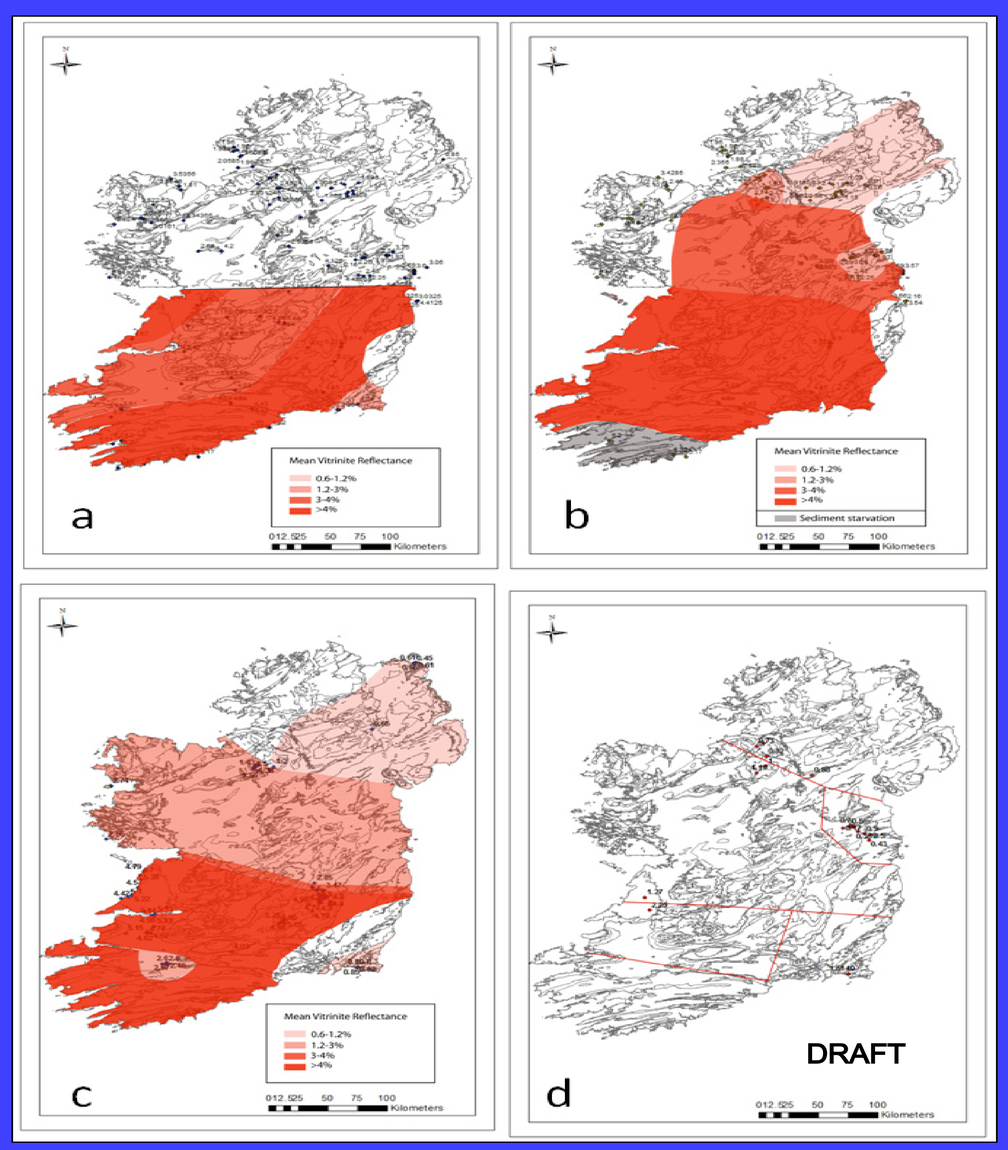

Figure 3. Mean Vitrinite Reflectance data distribution in Ireland for a) the Base Carboniferous, b) the Base Viséan and c) the Base Westphalian. In the figure d is displayed the gradient map that was used to extrapolate vitrinite reflectance data that were not available.

Preliminary Conclusions

- The maturity map for the Base Carboniferous does not seem to follow any clear structural trend.
- The lowest values recorded are in the South East of Ireland (Co. Wexford).
- The Base Chadian shows a progressive increase in Rr from NE to S in Ireland.
- The Base Westphalian shows the same trend of the Base Chadian, but with lower values especially in parts of Co. Wexford.

Further Research

- Adsorption analysis to see how much CO_2 can be stored.
- Completion of CO_2/CH_4 adsorption experiments for higher Rr values samples, to define a more accurate trendline for Fig. 2.
- Rr analysis of further samples to reduce the uncertainty in the maturity map.

References

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