Thermal maturity distribution of dispersed organic matter in probable Silurian gas shales in the Baltic and Lublin basins (Poland) by means of 3D Petroleum System Modeling

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INTRODUCTION

In the last decade, unconventional resources have turn out to be a topic of great interest worldwide in the production of hydrocarbons. Building on the success in the U.S., exploration projects have recently been started in Eastern and Northern Europe, with special regard to Poland. The aim of this contribution is to provide a reconstruction of the thermal evolution of the Polish Baltic and Lublin Basins, two NW-SE elongated basins, whose subsidence, active since at least Lower Paleozoic times and prevailing on denudation periods, was driven by Caledonian, Variscan and Alpine cycles dynamics.

Thermal maturity distribution was focused on the Llandoverian clays in the Baltic Basin and on the Wenlock stratigraphic record in the Lublin Basin to provide a reference framework for shale gas potential evaluation.

STRATIGRAPHIC AND THERMAL MODELS

3D burial and thermal modeling was performed by means of Simba software integrating classical stratigraphical data with organic petrography (Ro%) and geochemistry (TOC and Tmax) data derived from seven public wells in the Baltic Basin (Grotek 1999; Poprawa et al. 1999; Karkowski 2003; Siemon & Modrinski 2003; Poprawa & Grotek 2005; Grotek 2006; Modrinski et al. 2007; Poprawa & Korzenowski 2008; Poprawa 2011a, b; Poprawa et al. 2010) and nine public wells for the Lublin Basin (Zywiecki & Poprawa 2003; Poprawa & Grotek 2005; Grotek 2006; Poprawa & Zywiecki 2005; Zawadycki 2005; Poprawa & Korzenowski 2008; Poprawa 2010a, b; Poprawa et al. 2010) as well as present-day temperature and structural maps (Gorecki et al. 2006).

Modeling allowed to perform a series of geological and paleo-thermal scenarios that helped in the identification of areas of limited extension within each basin that turn out to be particularly attractive for gas exploration and prove for further investigations. Furthermore the major geological and thermal events that shaped the Baltic and Lublin Basins arise from the performed models.

CONCLUDING REMARKS

Favorable features for shale gas prospectivity are:

- area: depth > 3.500 m (Hc), 2. thickness > 35m (Lm), 3. Ro% between 2.35 and 2.00 (Wyle et al. 2007), 4. HI < 100 mg HC/g (En), 5. TOC > 0.5% (Wyle et al. 2007), 6. brittleness; 7. favorably oriented sets of fractures.

In order to identify the most prospective areas in the Baltic and Lublin basins, maps of depth of the base (Figs. 10a and 11a), thermal maturity (Figs. 10b and 11b) and thickness (Figs. 10c and 11c) of the potential productive intervals have been compared and integrated with scattered TOC data (black dots in Figs. 10c and 11b). This allowed to identify the most prospective areas in both basins (Figs. 10d and 11d).

CITED REFERENCES

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