Section A

Exam: Petroleum geology of the North Sea area
Date: 28 Jan 2009

1) Are the following statements correct or not correct (motivate your choice):
   a) Temperature and pressure have the same importance in the generation of source rocks
   b) The composition of the source rock is not important for the formation of oil
   c) If you bury a source rock it will always generate hydrocarbons

2) Describe the Tertiary geological evolution of the North Sea Basin and what is the prospectivity for oil in this Tertiary section (please explain).

3) A new oil company wants to initiate exploration for hydrocarbons in the Netherlands. They are specialized in calcareous reservoir rocks and they want to investigate the prospectivity of this rock type in the Netherlands. They ask you (for a splendid fee) to advice them. What is your detailed answer?

4) Describe a possible Pre-Silesian petroleum system

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Section B

1) Sketch in a few drawings the development of a salt dome, indicating development of a turtle-back anticline and rim-syncline.

- Where in the sequence would you expect the best chances for sand, and where not?
- What kinds of oil and gas trap styles may be associated with salt structures?

2) In the core of the inverted Broad Fourteens Basin a well is drilled on a well-defined structural high at the level of Rotliegend (objective), but found it to be water-bearing. The following stratigraphy was found: Tertiary: 1000 m thick; Cretaceous 0 m; Jurassic: 800 m; Triassic: 700 m; Zechstein salt: 500 m; Rotliegend reservoir: 200 m.

- What could be the reason of not finding gas?
- What can we say in general about the risks of exploration in inverted basins, and why?

3) A well has been drilled in the shallowest prospect in a pressure cell (prospect A). The well found the reservoir overpressured and water-bearing, but with good gas shows. We strongly suspect that the seal was breached because of seal failure due to the overpressure.
There are 2 deeper prospects (B and C) in the same pressure cell.

- What can we say about the chances of finding gas in prospects B and C?
- What can we say about the gas columns we may expect to see in prospects B and C (draw on the pressure-depth plot – the cross section is aligned with the depth of the plot)