

Oil and gas of the Norwegian Barents Sea

Jon H. Pedersen¹, Dag A. Karlsen¹, Harald Brunstad² and Jan E. Lie²

¹Department of Geosciences, University of Oslo, P.O. Box 1047 Blindern, N-0316 Oslo, Norway

²RWE Dea Norge AS, P.O. Box 243 Skøyen, N-0213 Oslo, Norway

Oil

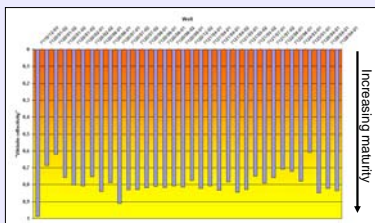


Fig. 1. The maturity of a set of Barents Sea oils expressed by aromatic compounds (methylphenanthrenes). The maturity varies from 0.6 to 1.0 %Ro vitrinite reflectivity. (%Ro = 0.60 * MPI + 0.40 (Radke, 1988)) The oil window lies within the maturity range of 0.5 to 1.3 %Ro, meaning that these oils are early to mid-mature with respect to the oil window.

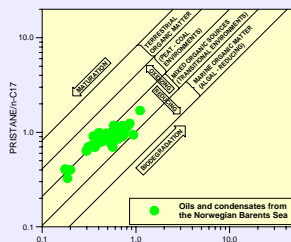


Fig. 2. A cross plot of isoprenoids versus n-alkane ratios indicates a mixed organic facies for the oils, probably due to facies variations in the assumed marine source rocks. The majority of the samples appear "mid-mature". Modified from Shanmugam (1985).

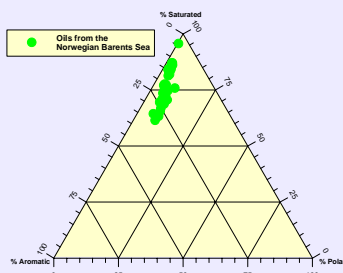


Fig. 3. The bulk composition of a set of Norwegian Barents Sea oils. The oils are rich in saturated compounds, and have a correspondingly low content of aromatic and polar components.

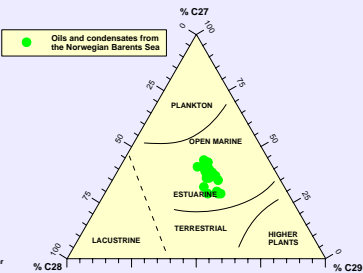


Fig. 4. A ternary plot of C₂₇, C₂₈, and C₂₉ regular steranes suggests a marine origin for a number of Barents Sea oils. Modified from Shanmugam (1985).

Reservoir rock



Fig. 5. Middle Jurassic oil stained reservoir sandstones of the Sto Formation from well 7121/5-1.

Conclusions

- The investigated Barents Sea oils originate from a marine type II source rock
- Source rock facies variations most likely occur due to varying organic input/level of oxygen in the depositional environment
- The oils composition is dominated by saturated components
- The thermal maturities of the oils vary from early mature to middle mature (0.6 to 1.0 %Ro vitrinite reflectivity)
- The investigated Barents Sea gases are thermogenic
- The gas samples are oil/condensate associated, i.e. the oil/condensate and gas originate from the same source rock
- The gas ranges from early mature to late mature with respect to the oil window (0.6 to 1.3 %Ro vitrinite reflectivity)

Gas

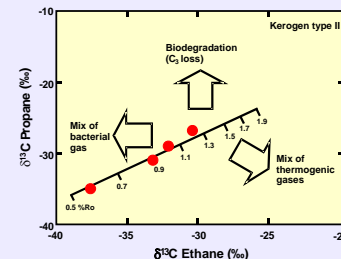


Fig. 6. The ¹³C isotopic values of ethane and propane in thermogenic gas from the Barents Sea points to a maturity ranging from 0.6 to 1.3 %Ro. The majority of gases are mid- to highly mature with respect to the oil window. Modified from Whiticar (1994).

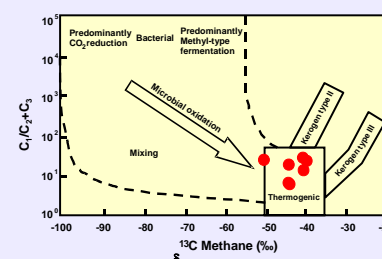


Fig. 7. The "wetness" of the gas (C₁/C₂+C₃) plotted against the ¹³C isotopic values for methane shows clearly the thermogenic origin of the analysed Barents Sea gas samples. Modified from Whiticar (1994).

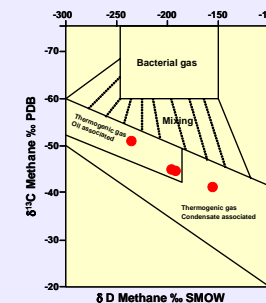


Fig. 8. The ¹³C and D isotopic values for methane indicate that the gas is thermogenic, and associated with oil or condensate. Modified from Schoell (1983).

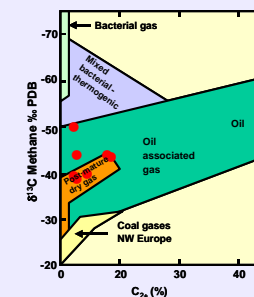


Fig. 9. The percentage of C₂+ fractions and the ¹³C isotopic values for methane indicate that the gas is a dry, thermogenic gas. Modified from Schoell (1983).