AAPG Search and Discovery Article #90022 © 2002 AAPG Hedberg Conference, September 8-11, 2002, Stavanger, Norway

AAPG HEDBERG CONFERENCE
“Hydrocarbon Habitat of Volcanic Rifted Passive Margins”
SEPTEMBER 8-11, 2002, STAVANGER, NORWAY

Seismic calibration of heat flow – application of direct temperature indicators

Michael Erdmann[1]*, Arnd Wilhelms[1]#, Christian Zwach[2]

[1]Norsk Hydro Oil & Energy, R&D Centre, Bergen, P.O. 7190, N- 5020 Bergen
[2] Norsk Hydro, EPI, Angola Project Group, Kjørbo, Norway
* presenting; # contact: Arnd.Wilhelms@hydro.com

Calibration of regional basin models in areas of limited well control such as the Vøring and Møre basins offshore Norway remains a major challenge. The Tertiary heat flow evolution of the Norwegian passive margin has been the focus of many studies. However, it is suggested that the rift related heat pulse has minor importance for exploration in large parts of the deep water areas.

A novel approach to assess the recent heat flow is presented using direct seismic observations in large undrilled areas. In the Vøring and Møre basins this approach uses the regional opal-CT reflector in combination with regional 3D thermal basin modelling. The opal-CT reflector is related to the presence of biogenic siliceous ooze over large parts of these basins and, due to its low thermal conductivity, has an important impact on the present day temperature field.
We will discuss the following issues:

- Presence, physical properties and impact of low thermal conductivity siliceous biogenic ooze
- Application of seismically mapped opal-CT transition in combination with regional 3D basin modelling in assessing the regional temperature field
- Detection of zones of abnormal heat flow using difference maps
- Effect of ooze presence on reservoir quality.

During the Upper Tertiary times thick layers of biogenic siliceous ooze were deposited over large areas of the Vøring and Møre basins. High initial porosity and distinct compaction related to chemical diagenesis are the cause for its unusually development of thermal conductivity. These are also the reasons for the ooze to be easily recognised on seismic over large areas.

3D basin modelling was performed using depth converted regional maps of 10 horizons. The opal-A to opal-CT transition was modelled using a simple kinetic with an activation energy distribution and a pre-exponential factor based on published data and internal work in Norsk Hydro. The calculated depth to the completed opal-A to opal-CT transition is compared to the observed. Areas where the input (recent) heat flow is feasible result in a good fit of predicted vs. observed depth of the opal-CT reflector. Areas of differing heat flow result in large difference between the modelled and observed depth to the opal-CT horizon. Regional basin models can thus be calibrated with a higher degree of confidence.