

## Rifting Workshop – Panel Discussion

The workshop was concluded with a panel discussion chaired by Herald Ligtenberg.

The workshop is intended as a meeting place for the petroleum industry and research institutions to bridge gaps in knowledge. The main purpose of the panel discussion is to flag major gaps in our understanding of the problems related to the structural origin of large scale fault systems in the North Sea and to identify the most significant topics guiding future studies or research.

*Panel members:*

**Fred Beekman** (VU University Amsterdam)

**Jo van Buggenum** (Wintershall)

**Lo ten Haven** (TOTAL)

**Jan de Jager** (Shell)

**Folkert Majoor** (Gaz de France)

**Jan-Diederik van Wees** (VU University Amsterdam & TNO)

*Moderator:*

**Herald Ligtenberg** (NAM)

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The discussion was structured around two themes:

1. Gaps in our knowledge.
2. What information is missing:
  - a. What tools/ information do we need?
  - b. Which studies should be initiated (Joint Industry projects)?

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**Moderator** - Based on the presentations we have seen today, there is a lot of focus on regional approaches to understand the smaller details at prospect level. Furthermore, we saw three core topics being addressed in the presentations:

- 1) Rifting systems and related heat flow variation and their effects on hydrocarbon maturation.
- 2) Improving our understanding of large-scale fault trends.
- 3) Focus on syn-rift deposits (e.g. Broad Fourteens area and Triassic).

**Q. Moderator** - *Do we see a need for more research on one of these topics? Are there issues we could try to solve or better understand by dedicated research?*

**A. Folkert Majoor** – We ought to zoom-out from the small scale problems related to our own fields and license blocks. We should allow ourselves to see the “whole picture”.

**A. Jan de Jager** – Yes, we have to zoom out to a more regional scale, but beware, the “Devil is in the detail”. For example consider structural features such as a

## **Rifting systems and its significance for hydrocarbon exploration in the Netherlands**

“skinny graben”, small structures with serious impact that were presented at this workshop. To really understand what’s going on we like to be able to switch between scales.

**A. Lo ten Haven** – The presentations shown today indicate that the academic world focuses on large scale problems. Often they are zoomed out too much. Oil companies are more interested in small scale phenomena. A significant gap exists.

**A. Jan de Jager & Fred Beekman** – True, but differences in scale may not be the whole problem. We should tackle these problems by using a truly multi-disciplinary approach. This will automatically integrate the various spatial scales.

**A. Lo ten Haven** – In the Netherlands our company is looking into near-field opportunities. For us exploration is not the growth market it once was. We therefore need to focus on localized and small scale solutions.

**Q. Audience** – *Considering the data, is there evidence indicating major lateral displacement?*

**A. Panel** – There is no real evidence of major offset of structural elements. No examples are known of large scale strike slip movements as proposed in some regional structural papers. There is ample evidence for oblique movements, but with only relatively minor horizontal displacement - in most cases less than the vertical displacement. Lateral displacements possibly reach in a small number of cases up to a few hundred metres, but generally in the order of metres to tens of metres only.

**Q. Oscar Abbink** (TNO) – *Does the public here think that a particular tool or technique is missing from the suite of commercially available tools?*

**A. Lo ten Haven** – Probably not for the majors, but perhaps the smaller operators are in need of better tools/techniques.

**Q. Christel Hartkamp** (EBN) – *Why not drill a well specifically designed for extracting maximum knowledge of faults and fault sealing phenomena?*

**A. Panel** (unanimous) – We could never justify the expenses from an economical point of view, nor would we know for certain which fault(s) to drill.

Also investment in a deep seismic line (very useful for academic purposes) did not get much encouragement from the industry panel members.

Q. Moderator – On what kind of Joint Industry Projects (JIP), research or studies should be focused?

Integration data bases

Remark **Veenhof** (Cirrus) – JIPs and studies can be very useful, also for new entrants.

**Audience** - As an example the TNO Velmod (A seismic Velocity Modeling time-depth conversion tool/database) study is quoted. This is a tool typical for large-scale studies. But we can learn a lot from the results it produces. It is useful to “screen” prospects and before working on a detailed zoom in. Therefore, these ‘large scale studies are not a bad thing per sé’.

A. **Jan-Diederik van Wees** – Looking back at this discussion, I feel there is a need for better integration of large and small scale data sets. In that way we can switch between spatial scales if and when required. This seems especially important to smaller operators with an active interest in exploration.

A. **Jan de Jager** – In the Netherlands, the major operators have access to their own modeling tools and lots of data. The smaller operators do not have access to these complex and costly tools and usually have little data. Small operators therefore have a need for new quick screening tools.

A. **Bert Dijksman** (Panterra) – The first thing we need is (more) data in the public domain! Some of this data is available on the TNO website, but lots of important basic (well) data is still present in proprietary oil company databases. If only we could have access to this kind of information.....

A. **Jan de Jager** – We will look into this suggestion.

Remark **Audience** – The presentation of the K5-13 (this workshop) has shown that it is very important to analyse dry exploration wells. A study of all dry holes in the Netherlands is suggested.

Palinspastic reconstruction, charge & migration history

**Q. Moderator** – *A useful methodology would be a tool for quick palinspastic reconstructions. Find out how much of sedimentary rock has been eroded. Many other methodologies require such information as basic input. What does the panel think?*

**A. Jan-Diederik van Wees** – Such approaches have been tested at the University of Amsterdam, for instance in a “Fission-Track” study. This study did not yield a publicly available tool.

**Jan-Diederik van Wees** – Suggests studies on charge history and fluid flow.

**Lo ten Have** – Do we know enough about kinetic parameters of Dutch coals?

**Hanneke Verweij** (TNO)– Suggests studies of late movements and migration.

Sealing fault studies

**Q. Lo ten Haven** – *A common issue is fault sealing capacity. We need to understand why some faults are sealing and others are not. Is it SGR or cataclasis?*

**Q. Jan-Diederik van Wees** – *To expand on that idea, would it be possible to study Rotliegendes cores and integrate it with seismic information?*

**A. Harmen Mijnlief** – It is well known that most (permeable) fault zones seen in core material, usually consist of only rubble (poor core recovery). The suggested approach therefore has a limited chance of success. What we should try to do is place the coring materials back in their original well location and then try to find a correlation with fault-related characteristics inferred from open hole logs.

**Remark Audience.** – When comparing well data in relation to seismic, a significant uncertainty exists in fault position. The suggested approach therefore may produce erroneous results. Also, for precautionary reasons, most wells conventionally are drilled not close to known faults. Only a few cores exist giving evidence of fault zones.

**A. Lo ten Haven & Jan de Jager** – We (the speakers represent two of the major operators) would be more interested in a screening environment that allows us to assess fault sealing characteristics. The next step would be how to incorporate this knowledge into petroleum system modeling to better predict (and prevent) the occurrence of dry wells.

Study of Pre Variscan fault patterns

Q. A few years ago TNO performed a large joint industry study collecting pre Silesian data in the Netherlands. Are companies interested in a sequel?

Q. **Harmen Mijnlieff** (TNO)– To truly understand the history of the rifting process in the North-Sea area, it would be interesting to find out the nature of major fault systems pre-dating the Carboniferous. Would such a study be feasible?

A. **Jan de Jager** – Due to limited seismic resolution at these great depths it will be difficult, if not impossible to make definitive statements on the origin of faults and fault systems.

A. **Lo ten Haven** – At these depths (> 4500-5000 m) reservoir properties would be those of a “tight reservoir”. And there you run into common economical problems related to tight gas ventures. If we can’t economically exploit tight resources at shallow depths no one will be interested in sub-carboniferous plays.

Other studies that were briefly mentioned are:

- Dynamics of structuration, fault systems.
- Analysis of the stress systems.

End of Discussion.