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# The structural evolution of the Netherlands onshore – a 2D analysis

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The Netherlands have despite their small size a very complex underground. The project presented here deals with the evolution of the basins and highs of the Netherlands onshore. In order to understand the evolution, a 2D line was selected that crosses the Netherlands from the Southwest to the Northeast which is almost orthogonal to the mayor faults bordering the structures. Along this line several wells were selected and 1D temperature modelling was performed. These models were calculated using PetroMod (IES, Aachen) and calibrated using vitrinite reflectance data.

In order to build a structural consistent model, the line was modelled with the structural modelling tool 2DMove of Midland Valley. This was necessary to include the effect of inversion that shaped most of the structures of the Netherlands.

In the Netherlands underground one can see the results of rifting and compression. In the Carboniferous the Variscan Orogeny was the first distinguishable phase of compression in the area. Deeper structures cannot be seen due to burial depth. The loading of the Variscan Mountains produced a foreland basin in which Carboniferous sediments were deposited. Additionally NW-SE trending faults were formed or reactivated. The compressional movements ended in the late Carboniferous and in Early Permian extensional movements prevailed. This resulted in the creation of several faults and volcanic activity that can be seen in parts of the Netherlands. During the Triassic the extensional movements continued but the direction of the force was altered a little as can be seen by faults trending slightly different. The tectonic instability increased from the Middle Triassic onwards when the extensional movements created several fault zones (as the Holsloot Fault Zone). During the Late Triassic the

movements diminished but intensified again during the Jurassic. This can be seen by the depositional pattern of the Aalburg formation. The extensional stresses were then trending ENE-WSW and created the major basins of the Netherlands onshore (West and Central Netherlands Basin). During the Cretaceous further extension took place until during the Coniacian the collision of Africa and Europe created another compressive stress regime. The compressive stress triggered the inversion of the basins and inversely reactivated the faults bordering them. The inversional movements ceased at the beginning of the Campanian and removed locally up to 3000m of sediment. During the Cenozoic the compressive stresses reactivated the inverted faults again several times, but to a lesser degree.

The structural model will now be incorporated in the temperature and pressure simulation to analyse and calibrate the temperature and pressure history. With this model it will be possible to gather detailed information on the Netherlands underground evolution and history and to perform consistency analyses.

References

TNO-NITG, 2000: Geological Atlas of the Subsurface of The Netherlands, Explanation to Map Sheet VI: Venndam-Hoogeveen.